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MOTORSHIP

Devoted to Commercial and Naval Motor Vessels

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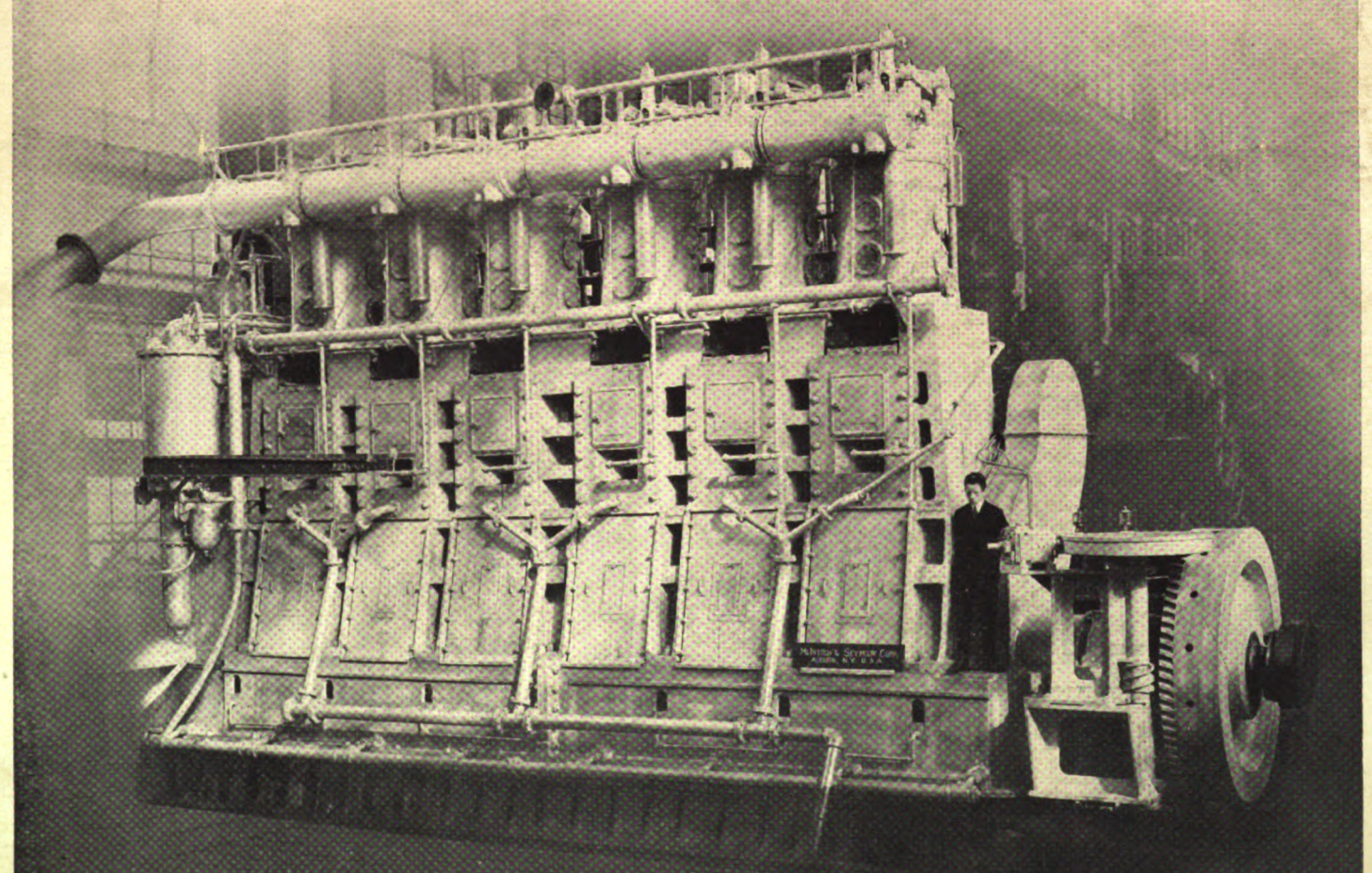
Vol. 7 No. 7

DIESEL MARINE ENGINES
FOR ALL CLASSES OF SHIPS



Mc INTOSH & SEYMOUR CORPORATION
AUBURN, N.Y., U.S.A.

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EXCLUSIVE technical and non-technical articles on design, construction and operation of oil-engines and motorships by the world's foremost writers on marine engineering.

MOTORSHIP

PROFUSELY illustrated with photographic reproductions of the newest designs in international merchant motorship and Diesel-engine construction and auxiliary equipment.

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U. S. War Department's Concrete Motorship Fleet

First Details of Seven Successful Winton Diesel-Engined Twin-Screw Passenger and Cargo Vessels

POSSIBLY the average shipowner feels that he has read and heard enough about concrete ships, believing that because all the war-time concrete steamers were more-or-less failures all such craft should be so classified. Naturally, the stories of the failures were given prominence in the press of the country until it became almost axiomatic that concrete ships spelled "failure" and an unwarranted waste of money.

However, MOTORSHIP has long known and has referred to a fleet of seven Diesel-driven concrete motorships built for the U. S. War Department from Col. P. M. Anderson's designs, which according to results to date, are unqualified successes. Until now the Department has rigidly withheld publication of details.

Recently we were enabled to inspect one of these craft at Washington, D. C., through the courtesy of Col. Anderson, who has been in charge of the entire construction of this fleet and other concrete motor-vessels, a number of which have gasolene engines and which have been previously described and illustrated in MOTORSHIP. The vessel on which we have just made the trip was the "Gen. D. H. Rucker," one of the fleet of seven propelled by twin Winton Diesel-engines.

Three of these ships are in service at Washington, D. C., Baltimore, Md., and New London, Ct., to which cities they made trips on their own power from the builders yard at Wilmington, N. C., where they were built by the Newport Shipbuilding Company. Each vessel is 150′ long by 28′ breadth and 10′ draught, and as will be seen by the illustration are of graceful design, and do not indicate in any way that they are built of concrete. In fact, technical men present when we were on the trip of the "Gen. D. H. Rucker" expressed surprise that she was the craft they had seen all Winter breaking up the heavy ice in the Potomac River and running about so buoyantly. Surprising as it may seem the increase in weight over that of a steel vessel is so slight that there is absolutely no impression of being on board a concrete-ship. Her two eight-cylinder 450 h.p. Winton-Diesel engines, together with two 25 k.w. Winton-Diesel generating-sets, Winton-General Electric auxiliary air-compressor, pump, etc., are installed in a large, well-lighted engine-room nearly amidships while forward of this are tanks holding about 12,000 gallons of fuel-oil.

While operated normally at 12 knots she is capable of 15 knots speed and created very little disturbance of the water, her flaring bows turning the bow-wave away clearly from the hull and there is practically no stern-wave. Her normal fuel-consumption is just one barrel of oil per hour, while 1.14 gallons of lubricating-oil are used for the same period.

There was not a blister on the paint anywhere nor could we find a single drop of water due to leakage, for there was none; she has not been pumped out since being launched in May, 1921, since her bilges are as dry as the paper on which these words are printed. Her forecastle is the driest we ever entered and there is no dampness anywhere. Yet her Master, Capt. P. D. Gau, and her Chief-Engineer, Chase Nash, assured us that they took Col. Anderson at his word and drove her through ice-fields five to six inches thick without causing a single leak or crack, although often she ran out 40 feet forward and was driven full-speed head-on to the ice and swung against it. The "Gen. D. H. Rucker" was operated all Winter after the steel and wooden craft found it impossible to get through the ice; she was the only vessel able to crush her way through the unusually thick ice except the Norfolk steamers, which are coastwise vessels of many thousands of tons fitted with special ice-plates.

Not once have her Winton-Diesel engines failed her, although she was operated in such severe temperature that her circulating-water suctions were filled solid with slush-ice which made it necessary to heat the sea-valves to obtain a flow of water. In our August issue we will publish a complete article dealing with these craft and with concrete-ships in general now in preparation especially for MOTORSHIP which we believe will prove of intense interest.

The U. S. War Department's motorship "Gen. D. H. Rucker," which has proved a success both as a concrete vessel and as a Diesel installation

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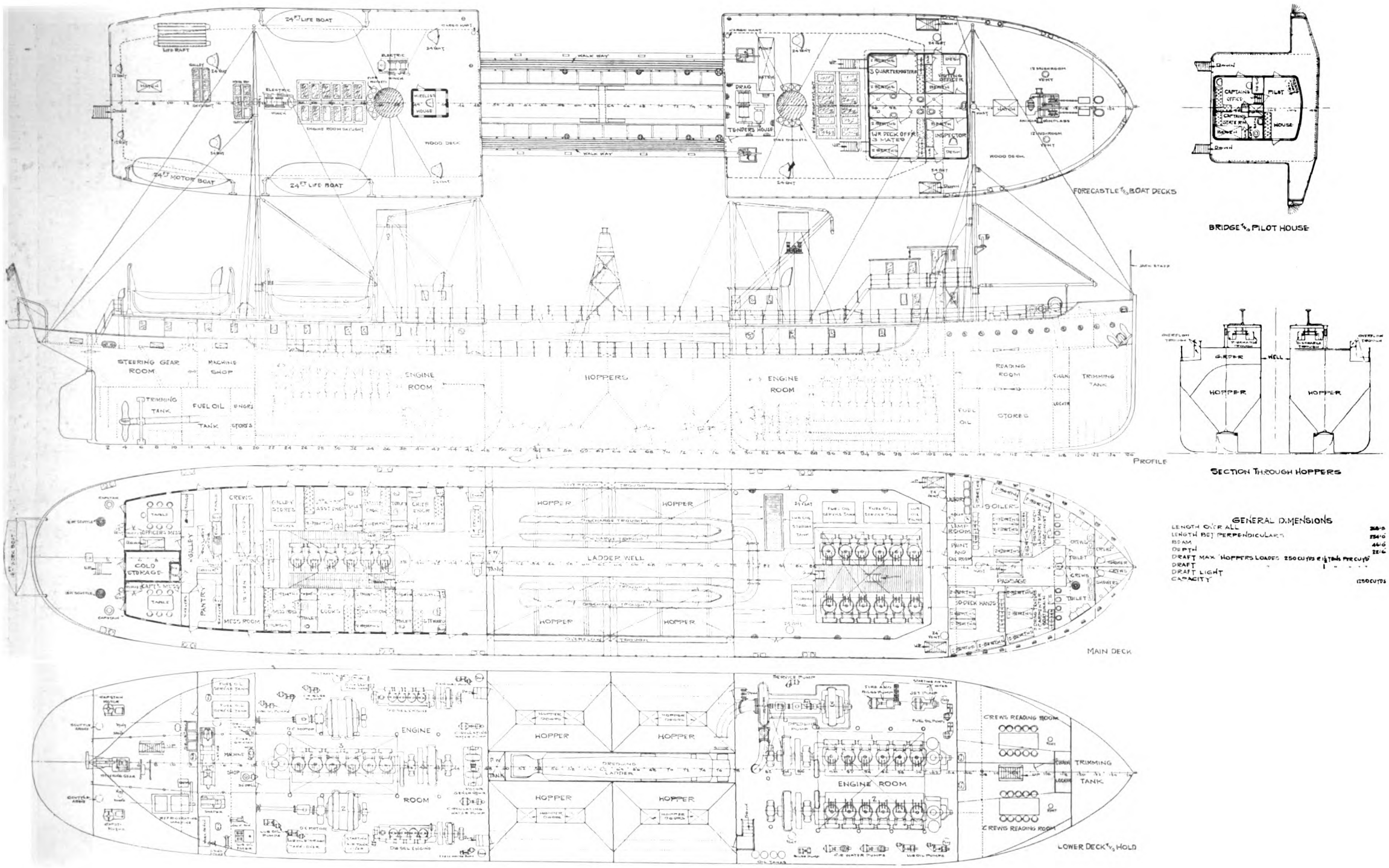

First publication of the plans of one of the four 3,000 b.h.p. Diesel-electric hopper-dredges to be built for the U. S. War Department. Three 1,000 b.h.p. crosshead four-cycle type McIntosh & Seymour Diesel engines and electric drive will furnish propelling and dredging power. For auxiliary power there will be two McIntosh & Seymour Diesel-driven electric generating sets of 225 b.h.p. Bids will be opened on August 2nd

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Diesel-Electric Dredges for U. S. War Department

Four Vessels of a Total of 13,800 b.h.p. to Be Built

SPECIAL attention is drawn to the advertisement of the U. S. War Department in this issue of MOTORSHIP which requests bids on the construction of four seagoing Diesel-Electric hopper dredges, to which we have previously made references. When the orders for these remarkable motorships, which are the first of their kind, are placed shortly it will be a great incentive to the development and the progress of this type of power in the United States, particularly as it will come about the time when bids will be requested by the City of New York on seven Diesel electric ferries. Two Diesel-electric cutters also are to be built for the U. S. Coastguard. Through the courtesy of the War Department we are enabled to publish plans of the dredges on the facing page.

These dredges will be of high power and will have three 6-cylinder, four-cycle, crosshead type McIntosh & Seymour Diesel-engines of 1,000 b.h.p. Each of these engines will be connected to a 700 K.W. 500 volt electric-generator. These engines which were originally built for the Shipping Board, will provide power for both propulsion and for operating the dredges. Twin screws each driven by a 800 b.h.p. 500 volt motor at 90 to 110 R.P.M. will propel the ship, while the main dredging equipment will consist of a 26" centrifugal pump driven by a 750 b.h.p 500 volt electric motor. There will be a suction ladder on the center line of the boat amidships, with discharge into the four hoppers of 1250 cu. yards capacity, also located amidships.

In addition to this main power equipment there will be two McIntosh & Seymour Diesel engines of 225 brake h.p. each, driving 150 K.W. 250 volt generators. Thus the total power of the Diesel-engines of the four vessels including auxiliary engines will be 13,800 brake h.p. There will also be a 25 K.W. 250-volt generating-set driven by a gasoline engine. Controls will be of the Ward-Leonard system, operated either from the pilot-house or the engine-room.

It is important to note that the auxiliaries throughout the ship, including the heating and cooking will be electrically operated. The dimensions of each of these vessels are as follows:

Length overall	268'5"
Length between perpendiculars	254'0"
Beam	46'0"
Depth	22'6"
Draft loaded	19'6"
Draft light	12'0"
Capacity	1250 cubic yards of dredged material.

The placing of the hull contracts doubtless will give much needed impetus to American shipyards. Much interest will be centered on these vessels and the engineers of the War Department should be congratulated in having adopted the most economical type of power for these craft. We understand that steam machinery will not be considered if included in any of the bids. The War Department, as well as many of the marine engineers and naval architects, have been keen readers of MOTORSHIP for many years.

"BINTANG," A NEW 3,500 TONS DANISH MOTORSHIP

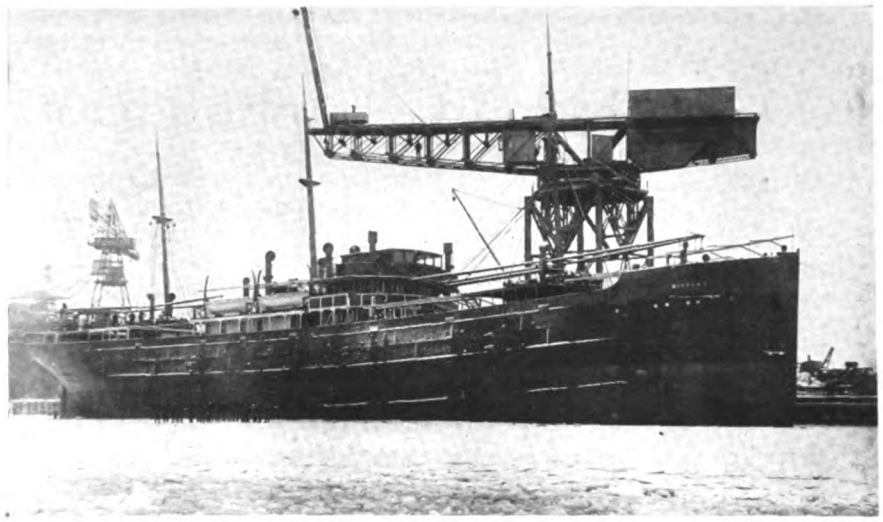
BY the time these words are in print the last motorship now under construction to the order of the East Asiatic Company of Copenhagen, Denmark, will have run trials, and the results will be published in a later issue. This ship is of particular interest and is a special type. Drawings and preliminary details were given on page 887 of our issue of November 1921. She was then known as the "Nakskov Yard No. 4," being in the early stages of construction.

She is a twin-screw vessel and is considerably overdue, the construction having been delayed by the post-war difficulties of securing materials. Consequently, had she been designed more recently, it is very probable that single-screw engine set would have taken the place of her present twin-screw set of a total of 1,400 i.h.p. At the time she was planned, a long-stroke trunk-piston or crosshead type B.&W. engine had not even been considered. The selection of the well tried-out twin-screw arrangement was partly due to the fact that she will be run by a native crew in the Siamese coastwise trade, where engine facilities are lacking, and where the advantages of maneuvering ability have weight.

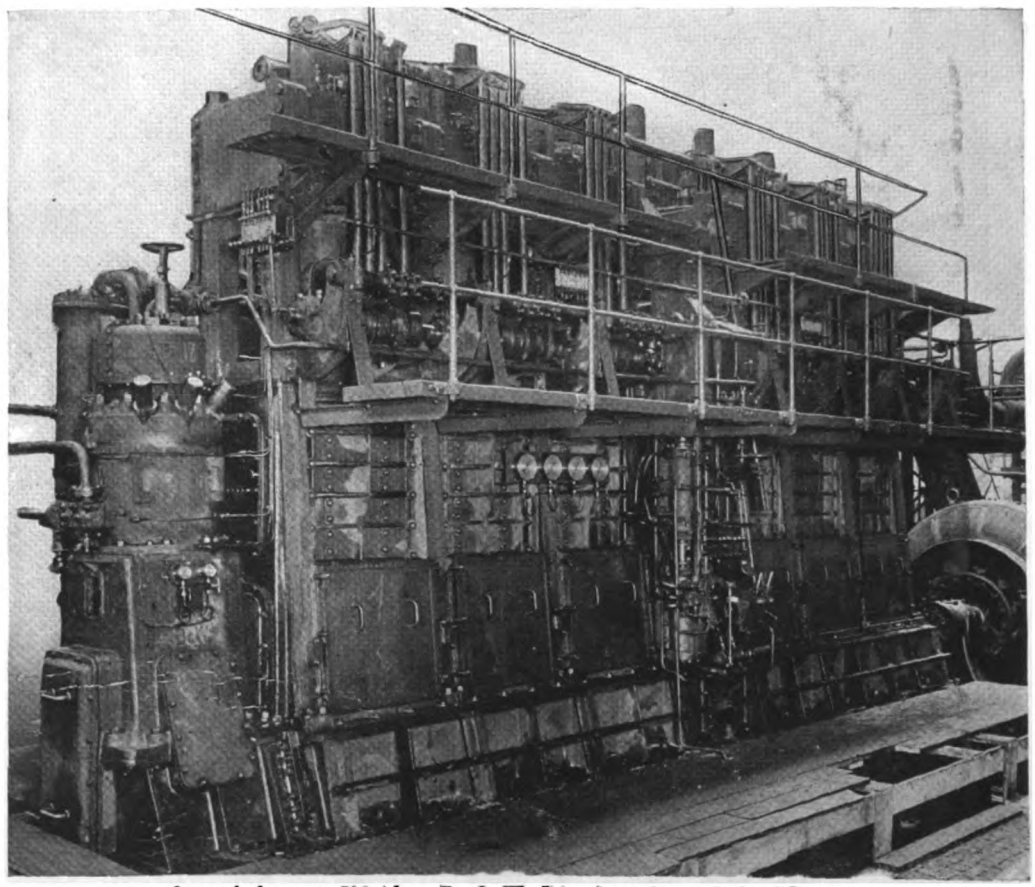
The installation of the two Burmeister & Wain engines has been carried out by the Nakskov Shipyard and is the 5th motorship constructed at this yard, the four previous vessels being the "Mexico", "Virginia", "Indien" and "Java." Her dimensions are:

Cubic capacity of holds	193,000 cu. ft. (bales) or 203,000 cu. ft. (grain)
Displacement loaded	5,900 tons
Displacement light	2,400 tons
Speed	11 knots
Power	1,400 i.h.p.
Length o. a.	302'
Length b. p.	284'
Breadth	44'
Depth (moulded)	28'

In addition to cargo, twelve first-class passengers can be carried in six 2-berth staterooms. The Diesel engines are of similar design as those built under license at the Akers shipyard, Christiania for Fred Olsen's two motorships "Brazil" and "Bayard", only instead of developing a total of 1,600 i.h.p. at 150 R.P.M. the speed will be reduced to 140 R.P.M. at which each engine will have an output of 700 i.h.p. The cylinder bore and stroke are 500 mm by 660 mm.



Motorship "Bintang" at the fitting-out dock



One of the two 700 i.h.p. B. & W. Diesel engines of the "Bintang"

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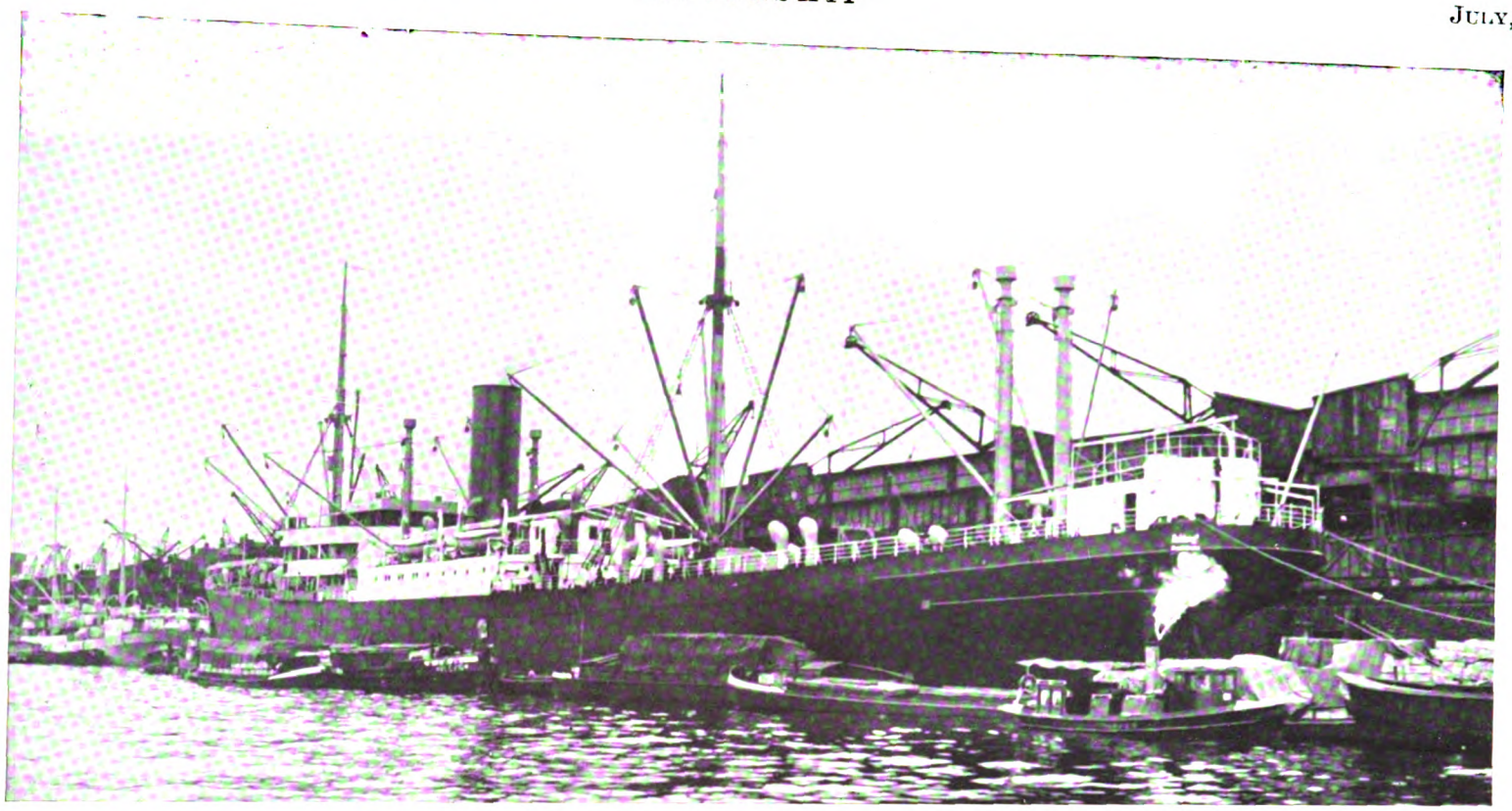


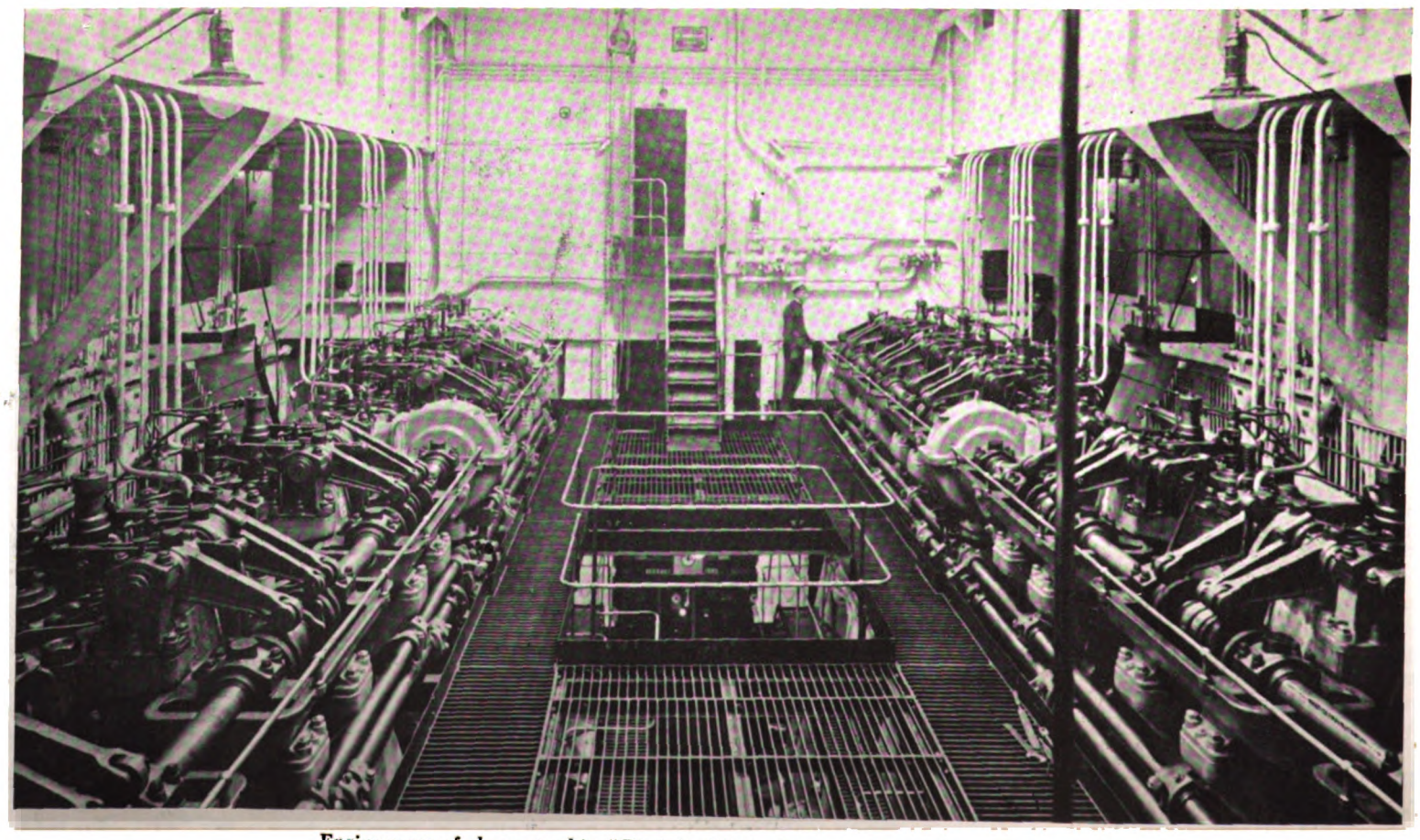
Hamburg-America Line's new twin-screw motorship "Rheinland" loading at their pier in Hamburg for her maiden voyage to the Far East. She is propelled by twin Blohm & Voss slow-speed type Diesel engines

A German Shipbuilder's New Departure

"Rheinland," First of the Hamburg-America Line's 10,000 Ton Motorships, to Be Equipped With the New Blohm & Voss Four-Cycle Slow-Speed Diesel-Engine — "Ermland," a Sister-ship, Now Completing

SEVERAL months ago a complete description was published exclusively in MOTORSHIP of the twin-screw motorships "Havelland" and "Munsterland," built by Blohm & Voss, and propelled by Augsburg submarine type high-speed Diesel-engines in conjunction with reduction-gears. While engaged in building these vessels Blohm & Voss were at work on the development of a new long-stroke slow-speed four-cycle type merchant-ship Diesel-engine, the first pair of which were fitted in the cargo ship "Rheinland," also of the Hamburg-American Line, and the second set is now being installed in the sister craft "Ermland." The original name of the "Rheinland" was "Westerland," but this was changed during the construction.

Like most German shipyards prior to the war, Blohm & Voss originally developed a two-cycle type Diesel-engine for ship propulsion—they carrying out experiments and developments in conjunction with and under license from the Nürnberg Works of the M. A. N. It will be remembered that they installed a pair of two-cycle Diesel-engines of fairly high power in the Hamburg-American Line freighter "Secundus," these engines being of similar design but of less output to those in-



Engine-room of the motorship "Rheinland," showing valve operating mechanism

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stalled in the U. S. Navy tanker "Maumee," built at the New York Navy Yard, Brooklyn.

However, Blohm & Voss are now turning to the four-cycle type, apparently having in mind that success can be more easily attained with this type, which is important at a period when neither maker nor owner can afford expensive experiments. The first vessel to be ntted with their new design of Diesel-engine, the "Rheinland," has run successful trials, and on April 22nd left Hamburg on her maiden voyage to East Asia, calling *en route* at Rotterdam, Penang, Singapore, Hongkong, Shanghai, Kobe and Yokohama.

Incidentally, it may be mentioned that the motorships building for the Hamburg-American Line are being named after German regions. As regards the geared-Diesel motorships "Havelland" and "Munsterland" we understand that they have been so successful in operation that it is probable a third motorvessel will be similarly equipped. This latter vessel was originally ordered, but was afterward cancelled because the German Government's financial support was insufficient to meet the rise in shipbuilding costs.

The "Rheinland" has the following dimensions:

Length	448′ 6″
Breadth	58′
Deadweight capacity	10,000 tons
Gross capacity	6,500 tons
Cubic capacity	17,770 cub. meters
Cruising radius	25,000 naut. miles
Power	4,300 i.h.p.
Engine-speed	95 R.P.M.
Fuel-consumption per 24 hours	12 metric tons
Ship's speed	12 knots
Fuel-oil capacity	1,800 tons
Engine-room crew	17 men
Total crew, officers, engineers and men	56
Bore and stroke, main engines	28.346″ by 51.181″

The "Rheinland" is of the shelter-deck type with three decks, double bottoms and eight water-tight bulkheads. She is rigged with two masts equipped with wireless and has a stack with enclosed sanitary and drinking-water tanks. Naturally the principal interest of this vessel centers on the new design of main Diesel-engines, which are of the open-frame class. Unfortunately, no technical description is available, other than that which can be secured from a study of the engine-room illustration.

Like many other German shipbuilding companies, Blohm & Voss have not adopted the "wide open door" policy of publicity on engineering matters, so it is to be hoped that the vessel will shortly visit this country, in which case we will make a special point of securing technical details for the benefit of our readers all over the world.

Each engine has six cylinders of 720 mm. bore (28.346″) by 1.300 mm. (51.181″) stroke and develops 2,150 i.h.p. at 95 R.P.M. On the trial run each engine showed an output of 2,175 i.h.p. with a fuel-consumption between 132 and 134 grams, or 0.29 lb. per i.h.p. hour, this giving the vessel a speed of twelve knots and with a fuel-consumption at the rate of twelve metric tons per twenty-four hours. The six cylinders are arranged in two groups of three cylinders with the drive for the camshaft and fuel-pumps between. Each cylinder-head has the usual five-valve openings for the air-starting, combustion-air inlet, fuel-injection, exhaust and safety-valves, respectively. At the forward end of each engine is the main three-stage type air-compressor. At the after-end the Michell double-thrust bearings take the place of the old type horse-shoe thrust-block.

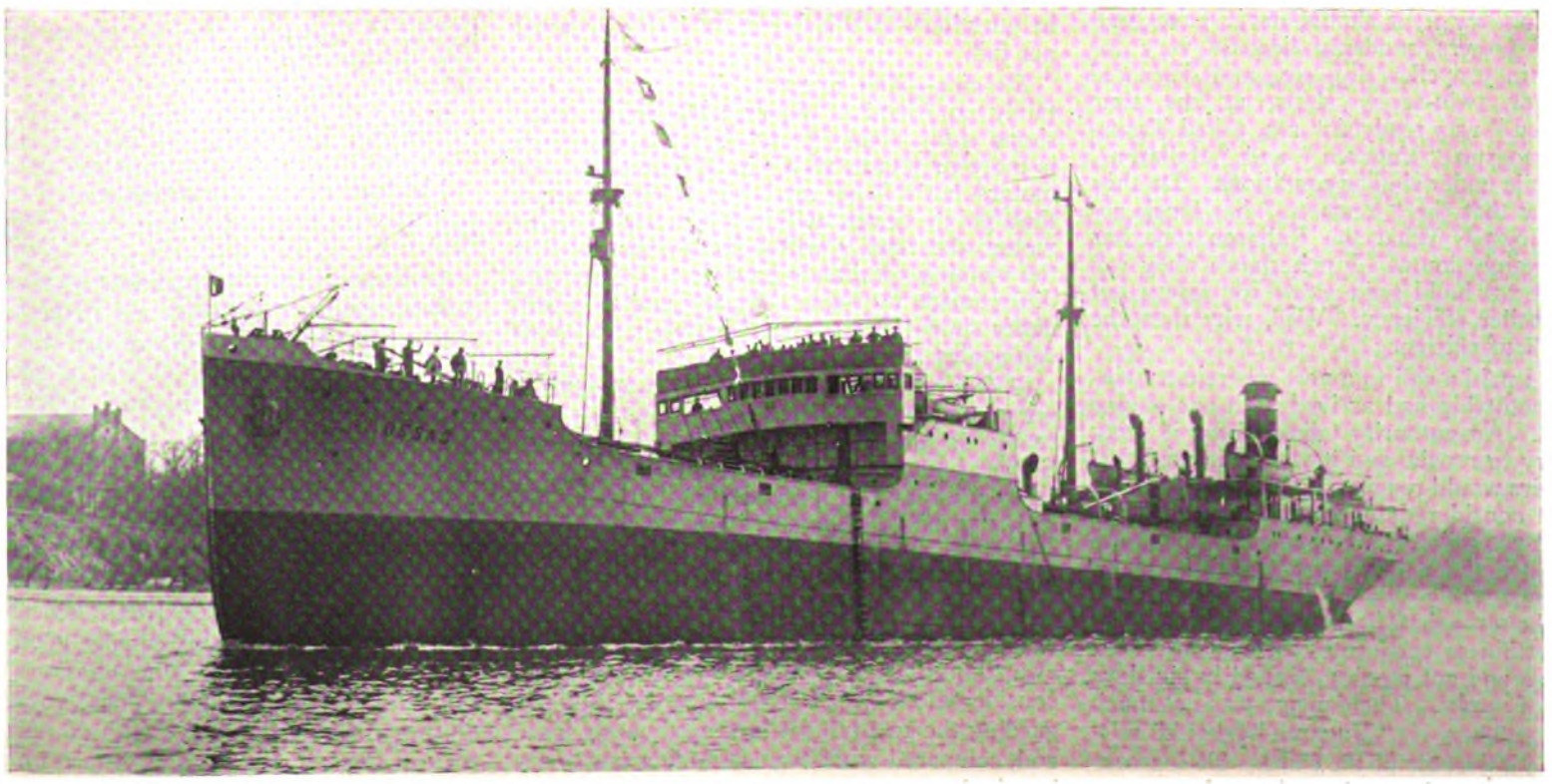
Altogether the total number of officers, engineers and crew amounts to fifty-six men, and of these seventeen are in the engine-room, as follows: Chief engineer, first, second, third and fourth assistant engineers, four junior engineers, seven oilers and one electrician. The other members of the crew are Captain, first, second, third and fourth officers, doctor, paymaster, chief steward, four assistant stewards, two cooks, carpenter and twenty-three seamen and boys.

As regards wages, we presume they come under Class A of the new German wage schedule which came in force April 1st. The deck officers' wages vary from 3,300 marks to 4,200 marks per month, according to rank, while the engineers' wages vary from 3,425 to 5,500 marks per month, according to whether fourth or chief, respectively. Board money amounts to 50 marks per man per day, while overtime is paid at the rate of 14 marks per hour.

There are two auxiliary M.A.N. Diesel engines of 180 b.h.p., one on the port side and the other on the starboard side, coupled to an electric generator of 95 K.W. at 300 R.P.M., or 68 K.W. at 200 R.P.M., which is operated with the load in accordance with the demand for electric power.

With this design of auxiliary Diesel-engine water cooling is led to the valve spindles through rubber connections, which we recollect has been previously adopted for similar purposes with other engines, with satisfactory results. Also on the port side of the engine-room there is a 20-ton per hour fresh-water pump operated by compressed air or steam—steam being taken from an oil-fired donkey-boiler at the forward end of the engine-room and which operates at 57 pounds' pressure. This boiler is mainly used for heating purposes. When the main-engines are running this boiler is fired by means of the exhaust-gases, heat being drawn in by blowers mounted on deck behind the stack. There is the usual run of ballast, fuel and service pumps driven by electric-motors, in some cases through reduction-gears. There is an emergency air-compressor driven by a single-cylinder surface-ignition oil-engine of A.E.G. make.

Altogether there are 18 compressed-air storage-bottles in the engine-room, six of which are for maneuvring and two for injection-air. Then there are four daily-supply fuel tanks of 5,000 kg. each, and two lubricating oil-tanks of 7.5 metric tons apiece. There also is an electrically-driven oil-purifier of German make, which is installed in a small room off the engine-room. In the engine-room flat are two cooling-water tanks served by electrically-driven centrifugal-pumps. Before being discharged overboard the cooling-water must pass through these tanks, which are connected with a large tank in the ship's double-bottom, so that the big tank is filled before any water can be discharged overboard. Presumably this arrangement has been adopted to have cooling-water available when the engines are being run in shallow water or at the dock, thus preventing the cylinder-jackets filling with mud, such as is sometimes the case when the vessel is moving in shallow water. On deck there are 17 Siemens-Schuckert electrical-winches mounted in groups of three with one exception. Six of these winches are of 5 tons capacity, the balance having a three ton lift. Accommodation has been provided in the deck-house under the flying-bridge for a comfortable saloon and six 2-berth cabins for 12 passengers.



"Ossag," the second single-screw B. & W. type Diesel-engined tanker built and engined at the Deutsche Werft Shipyard, Hamburg **(See page 538)**

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Impressions of Motorship Construction in Germany

By EDWARD P. FARLEY
Vice-President, United States Shipping Board, Emergency Fleet Corp.

(*Written especially for* MOTORSHIP)

IN the present condition of her Merchant Marine, Germany has one great advantage over her competitors. This lies in the fact that while their fleets are largely comprised of old, and in many cases worn out vessels, Germany is starting with a 'Clean slate,' and in a comparatively short space of time may have a fleet almost entirely comprised of vessels of the most economical and efficient types.

In view of the developments of the past few years, there can be little doubt but that the principal move for economical ships, which the Germans can make, will be the very general adoption of Diesel engines for their long voyage cargo ships.

Statistics at hand indicate that the production of merchant vessels in Germany for the present year will be in the neighborhood of 450,000 or 500,000 gross tons. What proportion of this fleet will have Diesel machinery there are present no figures at hand to indicate, but it seems certain that a considerable number of ships will be equipped with this type of machinery.

While the Diesel engine is still in a state of development and while it will probably be some time before a final and standard type of Diesel engine will be generally recognized, it must be remembered that the German engineers, both by nature and training, are peculiarly fitted for the effective solution of just such problems.

Actual Running Costs of Motorships

(*Continued from page 446 June issue*)

In the case of Doxford's, we certainly gave them a good hand at the start. How many motor builders do know about, or, if they do know, prepare efficiently for the motor's spending months in the tropics where the cooling water is +33°C., and the humidity is 80 to 90 per cent., and the temperature of the atmosphere + 33°C.? I remember a refrigerating engineer who would not believe that the cooling water was +33°C., thus a little above the CO^2 critical temperature. But so it is; the tropical conditions are often severe.

The author of a certain book on motors, who lives almost next door to Doxford's works, writes in 1921 about the Doxford engine: "Many mechanical difficulties have yet to be overcome before this type can be applied successfully for ship-propulsion." He either did not know his business or something was wrong otherwise; else, why could he not wait and see? Who needed his opinion? Unfortunately many people read and believed. At that time the motor was going on board the ship and to-day "Yngaren" is home from Java and Australia having experienced no mechanical difficulties whatsoever.

Another man, one of the temporary engineers on Transatlantic's now wrecked "Elmaren," wrote in the American *Motorship* quite an article. If he were right, Burmeister's engine would not have been the present-day success it is. If he were wrong, and the Editor saw it, it should never have been printed. Others suddenly become very interested in propeller slip, etc., and discussed single- or twin-screw ships, at the time "Yngaren" was ready for sea, asked Transatlantic to run "Yngaren" and "Bullaren" on the mile under similar conditions. Do they not know that the "Yngaren" has block coefficient 0.77? What the Bullaren type has they certainly know. Furthermore, they say they did not build twin-screw for safety but for propeller efficiency. Well, why then the worry about efficiency? * * *

Once I paid a call to a port wherein a twin-screw motorship had arrived with one engine disabled. An authority talked about it being necessary to repair, and it was estimated that the repairs would require six weeks. The ship was not considered seaworthy for a passage of about 500 miles. It helped me much, however, to tell them that I was travelling about in a single-screw ship of the same size and almost the same shaft horsepower. The ship got a seaworthiness certificate, arrived safe with her cargo and got repairs effected in six days instead of weeks. The damage was not much * * *. Thus if "Yngaren" should misbehave it is just about the same. To increase the number of the engines for safety is no good. The main thing is reliability.

Valuable Information Released by a Big Swedish Shipowning Company Who Have Ordered Motorships with Three Designs of Diesel Engines

By TADGE MADSEN
Superintendent-Engineer, Transatlantic Steamship Co. Goteborg

Should we not all admire the shipowners who at present have built or are building motor-ships? Let us nevertheless enjoy the fact that they did not take steam engines. And shall we not all admire firms like Burmeister & Wain, Doxford's, Scott's, etc., who have and are spending money in carrying the internal-combustion engine further to final and complete reliability? But let us anyhow hope they will work amicably together over one point at least and that is to talk about shaft horsepower, otherwise it will be as many different motor powers as there are motors in the market for all days to come. From this you may understand that I am aware of the fact that there are many good motors in the market. The shipowner must always be prepared to avail himself of these and he must keep an open mind on the subject. Generally speaking choosing among the good motors I do not think the type of motor means such a great deal at present so long as the shipowner provides in the right way and spirit for the safe and good running of the particular motor in question—in this he most decidedly must not fail.

Repairs.—The average shipowner is certainly no friend of repairs; the engineering-shops enjoy them * * *. Certainly there is more or less to repair in different types of motors, but it is not my business here to argue that point. Even within the same type of motor, the repairs will differ owing to what the running conditions have been. They will differ inside the same company and they will differ unnaturally much between different companies * * *.

A few consumption figures, etc.—I will try not to weary you in this part of my Paper; I really do not believe in too many figures. Some of you may have come here looking for them and may feel disappointed, but there are so many things of greater importance at present than a few grams more or less of fuel oil and lubrication oil in this type or that type. Certainly actual consumption has its importance. The shipowner will find that, when everything is well prepared for, he will make considerable savings * * *. Even disregarding the 10 per cent increased cargo space and, compared with steamers only a few hours lost in bunkering, the motorship has a more even speed and a higher average speed on the voyage, while her owners have the pleasure of a good conscience towards coming generations in not having wasted quantities of fuel * * *.

(1.) M.S. "BULLAREN."—Sydney, Newcastle, Adelaide, Belfast.

(Twin 2,000 i.h.p. Götaverken B. & W. Diesel Engines.)

Distance by obs.	11,773 miles
Distance by eng.	13,374 miles
Time under way	1,064 hours
Mean draught	25 ft. 9½ ins.
Revs. per minute	97.2
I. H. P. (twin screws)	3,850
Averaged speed by obs.	11.06 knots
Fuel oil per I. H. P. hour	145 and 142 grams (diff. oils)
Fuel oil per mile	48.7 and 48 kgs. (diff. oils)

The total consumption was:—

Fuel oil	Kgs. 615,500 (incl. drainage)
Lubr. oil	Kgs. 5,793
Compr. oil	Kgs. 393

Remarks.—This voyage was all right at the start but later on, having got a new fuel-oil, it was found necessary to make several stops for shifting valves. The fuel-consumption is perhaps somewhat high per mile but the ship having spent a long time in tropical waters, was foul on the bottom. The lubricating-oil consumption is also a little high but this oil is kept in compartments in the double-bottom and now and again has to be cleaned. In this case one such tank was cleaned and 2,600 kg. lubricating-oil disappeared which are included in the figure 5,793 kg.

(2.) M.S. "TISNAREN."—Gothenburg, Cape Town. Maiden voyage.

(Twin 2,000 i.h.p. Götaverken B. & W. Diesel Engines.)

Distance by obs.	7,231 miles
Distance by eng.	8,084 miles
Time under way	622 hours
Mean draught	24 ft. 5 ins.
Revs. per minute	102
I. H. P. (twin screws)	4,000
Average speed by obs.	11.63 knots
Fuel-oil per I. H. P. hour	147 grams
Fuel-oil per mile	49.7 kgs

The total consumption was:—

Fuel-oil	Kgs. 376,000
Lubr. oil	Kgs. 1,942
Compr. oil	Kgs. 165

Remarks.—The cargo was 3,000 stds. Swedish timber for Africa and 1,200 tons general cargo for Java. This voyage was a non-stop run, but the fuel oil was a good one. From Africa the "Tisnaren" proceeded to Batavia, average speed 11.49 knots, fuel per i.h.p./hour 147 grams, fuel per mile 52.37 kgs., i.h.p. 4,150. Mean draught 14 feet ¾ inch. The weather was bad, the governor working almost from port to port.

(3.) The M.S. "Tisnaren," later made several voyages in ballast from Gothenburg to Batavia. They were all equally good and I give here a typical one with no stops except those for the Suez Canal. These voyages are of special interest to those who do not find it natural that a twin-screw ship's propellers should have a good chance and a good water to work in, particularly when in ballast. In

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questions like this it is up to the owners and his officials to find out which is the more favorable, one or two screws.

Distance by obs	9,314 miles
Distance by eng	9,382 miles
Time under way	678.5 hours
Mean draught (1,000 F. sandball)	13 ft. 11 ins.
Revs. per minute	107
I. H. P. (twin screws)	4,100
Average speed by obs	13.72 knots
Fuel oil per I. H. P. hour	143 grams
Fuel oil per mile	42 kgs.

The total consumption was:—

Fuel oil	Kgs. 391,188
Lubr. oil	Kgs. 714 (excel. 900 kg. to tail-shaft)
Compr. oil	Kgs. 249

Remarks.—On another similar voyage there were several stops, but the average speed was even higher, being 13.76 knots.

(4.) "M.S. TISNAREN"—Return voyage, loaded.

Distance by obs	10,328 miles
Distance by eng	11,932 miles
Time under way	898.5 hours
Mean draught	23 ft. 10½ ins.
Revs. per minute	102-103
I. H. P. (twin screws)	4,150
Average speed by obs	11.49 knots
Fuel oil per I. H. P. hour	151 grams
Fuel oil per mile	52 kgs.

The total consumption was:—

Fuel oil	Kgs. 549,585
Lubricating oil	Kgs. 3,744
Compressor oil	Kgs. 265

In the above voyages, the fuel-oil per mile is for the main motors only. The differences as compared with the total consumption have gone to auxiliary motors or else overboard as drainage from the settling tanks, though on our ships very little is lost in the latter way.

Generally only one auxiliary motor is running; at 90 i.h.p., 300 kg. a day for this is a good average. The donkey-boiler is only used in cold climates for heating cabins, etc., and the consumption is negligible.

(5.) M.S. "YNGAREN."—Maiden voyage.

(Single 3,000 i.h.p. Doxford Oil Engine.)

The ship first went round to different ports in home waters and consumed about 42.8 kgs. of fuel-oil per mile under half-loaded conditions. The following report covers the trip Gothenburg to Batavia via ports in Norway, Germany and England. The figures really start from Hamburg where some fuel-oil also was taken on board, the bulk of it eventually being taken on in Brixham. The ship was favorably loaded.

Distance by obs	8,841 miles
Distance by eng	9,452 miles
Time under way	816.5 hours
Mean draught	22 ft. 0 ins.
Revs. per min.	69-70
I. H. P. (single screw)	3,100 for 7 days, 2,550 rest of time
Average speed by obs	10.82 knots
Fuel oil per I. H. P. hour	156 grams
Fuel oil per mile	43.1 kgs.

The total consumption was:—

Fuel oil, kgs	404,560
Lub. oil, kgs	3,125

Remarks.—30,000 kgs. of fuel-oil were consumed for the auxiliary motors and donkey-boiler. The latter has not been used since Port Said on the outward voyage. The auxiliary motors' average daily consumption is about 430 kgs. per day. The figure is pretty high, but the consumption has not been so perfect. The daily lubricating oil consumption for the main engine is about 67 kgs. and for all other purposes about 25 kgs. These latter figures may be considerably improved. In a new engine there is always much leakage, oil escaping everywhere.

We had eight stops of about 6 hours 55 minutes total time. I will return to them in a more detailed account of the whole maiden trip.

6.) From Batavia, the "Yngaren" called at Semarang and Soerabaya, and went from there to Brisbane.

Distance by obs	3,101 miles
Distance by eng	3,224 miles
Time under way	277 hours
Mean draught	18 ft. 9 ins.
Revs. per min.	69-70
I. H. P. (single screw)	2,550
Average speed by obs	11.2 knots
Fuel oil per I. H. P. hour	165 grams
Fuel oil per mile	37.62

The total consumption was:—

Fuel oil, kgs	122,210
Lubricating oil, kgs	1,485

Remarks.—The consumption per i.h.p. hour is rather high, the reason being that the sprayers had worn, thus impairing combustion. This trip was a non-stop run. From Brisbane the "Yngaren" called at Newcastle, Sydney and Melbourne, consuming, for about five days' run and unloading of the bulk of the cargo, 52 tons of fuel oil. The whole outward voyage totalled 15,536 miles, the fuel consumption for which was 646,400 kgs. fuel oil (main engine), or 10.72 tons per day. From Melbourne the "Yngaren" went to Sydney, went into drydock and was found to be foul on the bottom as had been expected.

(7.) In Sydney we loaded part cargo, returning to Melbourne to complete loading. Leaving Melbourne on March 25th, we anchored at Dunkirk on the 8th April.

Distance by obs	10,963 miles
Distance by eng	12,245 miles
Time under way	988 hrs. 19 min.
Mean draught	24 ft. 6 ins.
Revs. per minute	75.3
I. H. P. (single screw)	3,050
Average speed by obs	11.1 knots
Fuel oil per I. H. P. hour	174 grams
Fuel oil per mile	43.6 kgs.

The whole homeward voyage from Melbourne, 10,963 miles, 478,150 kgs. fuel oil (main engine) or 11.63 tons per day, were consumed.

(8.) Steamer "Auten."—Sister hull to m.s. "Yngaren," 3,000 i.h.p., but closed shelter deck. Maiden voyage, outward:

Distance by obs	8,372 miles
Distance by eng	
Time under way	831.6
Mean draught	27 ft. 1 in.
Revs. per minute	66
I. H. P. (single screw)	2,400
Average speed by obs	10.07 knots
Coal and oil per I. H. P. hour	
Coal and oil per mile	139 kg. coal, 28.8 fuel oil

The total consumption was:—

Coal	1,163 tons
Fuel oil	241 tons
Lubricating oil	760 kgs.

(9.) Steamer "Auten."—Homeward voyage, covering practically the same ground as the "Yngaren" on her present voyage, only that she left from Sydney instead of Melbourne, and arrived at Antwerp instead of Dunkirk.

Distance by obs	13,408 miles
Distance by eng	
Time under way	1339.6
Mean draught	26' 1"
Revolutions per minute	67.4
I.H.P. (single screw)	2,450
Average speed by obs	10.01 knots
Coal per I.H.P. hour	
Coal per mile	201 kgs.

The total consumption was:—

Coal	2,716 tons
Lubricating oil	1,060 kgs.

(*To be Continued*)

Diesel Development in the British Navy

(*Continued from page 446, June, 1922*)

By Engineer-Vice-Admiral Sir Geo. G. Goodwin, K.C.B., L.L.D., Engineer-in-Chief of the British Navy

Part II

About the end of 1911, in view of the oil fuel requirements of the Fleet, it was decided to build a number of oil-tank vessels, and arrangements were made to fit Diesel engines in five of these ships, the brake horse-powers of the various types of engines being 450, 1,500, and 2,500 respectively. Valuable information and experience were obtained as regards the nature of the problems to be solved both with respect to material and the training of *personnel*.

In the design stage of the "Hood" it was proposed to fit an oil engine of 1,200 horse-power on a centre shaft. This was increased later to 4,000 horse-power (to develop 3,000 horse-power at 185 revolutions per minute), and the final proposal was to fit two sets of eight-cylinder engines, each of 4,500 horse-power running at 185 revolutions per minute on the wing shafts, with three sets of turbines on the centre shafts. These proposals were subsequently abandoned.

Machinery for a tanker was built by Vickers, Ltd. These engines were designed to use Texas oil-fuel as usually supplied under the boilers. After the shop trials the engines were placed on board the oil-tank vessel "Trefoil"; the vessel was practically complete and ready for trials, when the machinery was ordered to be removed and fitted in a second monitor, the "Marshal Soult." I suppose no ship was so often in action as this monitor. These monitors were manned by naval ratings with R. N. R. engineer officers.

As a result of the experience in the "Marshal Soult," certain modifications, principally in the arrangement of the fuel-oil spray valves, were made on the replace set of engines for the "Trefoil," an oil-tank vessel. We regard with great satisfaction the fact that this ship did her first eighteen months of hard war service without being laid up, and without developing any defects except those that could be made good by the ship's staff. The subsequent cost of refitting has been heavy compared with steam engines of similar power, but we are quite willing to grant that this must be expected in an installation where there are 16 cylinders to the main engines, besides Diesel-driven compressors and the steam plant. These additional costs have, however, been far outweighed by the saving in fuel, in *personnel*, and other advantages.

The machinery for a large: twin-screw oil tank vessel was made by Vickers, and consisted of two sets of eight-cylinder four-cycle engines of a total power of 2,500. I am very glad to say that the trials and subsequent service of the main engines were generally satisfactory. The defects which probably caused most trouble were due primarily to leakage from the glands of the piston cooling pumps, and sometimes breakage of the pump parts; these pumps were of the trombone type. The salt water finding its way into the lubricating-oil, and possibly containing a certain amount of sand, caused the piston-rings to be gummed up and admitted of gas blowing past the pistons and gassing the engine-room staff. This leakage became so serious that the engines could not be started by compressed air.

About the end of 1911 arrangements were made for the construction of a single-cylinder experimental engine of 1,000 brake horse-power. The engine, which was of the two-stroke cycle type, was made by Vickers, and intended finally to form part of a six-cylinder engine of 6,000 brake horse-power. The diameter of the cylinder was 30 inches, stroke 36 inches, and revolutions 140 per minute. Compressed-air was used for fuel injection. The auxiliaries were separately driven.

The engine made a continuous run of 223 hours without stopping, of which time 103 hours were run at full power, 90 hours at four-fifths, and 30 hours at three-fifths; the fuel oil used was Texas oil, having a viscosity of 137 seconds Redwood at 70 degrees F.

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The chief features brought out in connection with the experimental work were the difficulties of thoroughly scavenging the cylinder and getting rid of the products of combustion, in keeping the valves, pistons, cylinder liner, and crosshead bearing cool, in designing the cylinder lining, piston and cover to stand the high temperatures, and in spraying the oil so as to produce efficient combustion at the comparatively high mean-pressure which was aimed at. The experimental work on this engine gave valuable information applicable to high-power engines of all types.

The mean power maintained during the 103 hours' trial, at full power, was 1,044, and the fuel consumption of the main cylinder alone during this period was 0.405 lb. per brake horse-power per hour.

The engine at the completion of the trials was considered an efficient working arrangement, capable of producing its full power for a further period, and that similar results could be expected if a multiple-cylinder engine of the same type were designed for higher powers. Moreover, the experience gained during these trials indicated how a combination of units of this type, if used for propelling a ship at sea, could be utilized for a required endurance, remaining efficient without important repairs.

Further experiments were made using Mexican oil, including a run of 90 hours, of which 30 hours were at full power, and the remainder at four-fifths and three-fifths power respectively. A mean brake horse-power of 1,043 was realized at full power, and the engine worked satisfactorily.

Further experiments were being carried out raising the Mexican oil-fuel to higher temperatures by placing electrical heaters on the discharge side of the pumps and using solid injection, when the war intervened and prevented any further experimental work in this direction. The trials strongly impressed on my mind that, when developments of this kind in the Diesel engine are in progress involving engineering consideration, thought, and skill of a very high degree, the commercial idea of using cheaper oils, probably unsuitable for such developments, should not be simultaneously pressed from other directions. The field for the experimental use of cheap oils is in engines which have passed through the trial stage, and the experimenting engineer should not be hampered and embarrassed while more important and high-class engineering trials are in progress.

At the end of 1912 it was pointed out that the close attention given by Continental engineers and manufacturers to the development of the Diesel engine for many years past has enabled them to accumulate a large fund of information, from which not only had there been a continuous development in size, economy, and reliability, but the methods of manufacture had also developed simultaneously, resulting in rapidity and cheapness of output. Having little of this experience, which could only be obtained first hand by laborious and patient research, our manufacturers were handicapped in comparison with those Continental firms.

In these circumstances there was reason to believe that the Admiralty would derive considerable benefit by obtaining Diesel propelling-engines for three 10,000-ton tankers direct from the best of the Continental firms.

The ordering of machinery from foreign makers would undoubtedly have had the effect of stimulating the development of this newly-started industry in Great Britain. Arrangements were accordingly made to obtain from Messrs. Carels, Sulzer and the M. A. N. Company machinery to the following requirements:—

Two sets, one right-handed and one left-handed, controlled from a position between the engines of two-cycle single-acting reversible crosshead Diesel engines for placing in a ship to drive twin-screws, and to develop in the aggregate about 3,200 brake horse-power (1,600 for each screw) at about 120 to 130 revolutions per minute.

Unfortunately before delivery of Carels' engines or those from the M. A. N. Company could be made, war broke out with Germany, and neither of these engines was delivered. The Sulzer engines were delivered after satisfactory shop trials. It has hoped to find an opportunity to fit these engines in a suitable vessel; unfortunately this opportunity did not arise.

Regarding submarine engines, it is in the attempt to obtain the maximum power for a given size of cylinder, combined with good efficiency and reliability, that we have to consider some important features, and on these features a large amount of our experimental work has been based.

As is well known, the factors on which the power for a given cylinder size (*i. e.*, bore and stroke) depend are:—

(1) ngine revolutions.
(2) The mean pressure developed throughout the working stroke.
(3) The number of firing strokes per revolution.

When (1) is considered, it has to be remembered that if the speed is increased beyond a certain figure the conditions are arrived at where the inertia forces may actually exceed the loads due to combustion pressures, and as these latter pressures in general govern the scantlings of important details, the importance of keeping down the inertia forces can be fully appreciated. The solution of this problem led to the use of pistons of aluminum alloy instead of cast-iron. By this means it was found possible to run an experimental engine of very similar design to a standard submarine-engine at a speed approaching 500 revolutions

(To be continued)

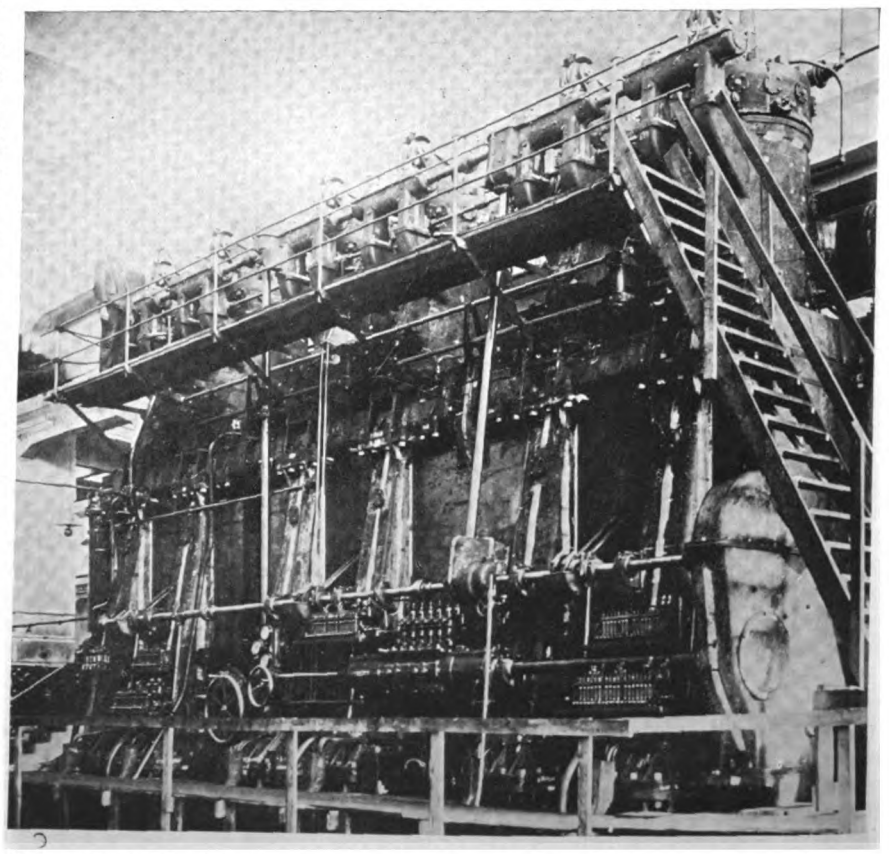
SLOW-SPEED ATLAS-POLAR DIESEL ENGINE OF 1,700 H.P.

There are now over half-a-dozen important Diesel-engine companies building merchant-ship oil-engines that develop their rated power of anywhere from 75 to 100 r.p.m., and the number of companies engaged in producing such engines for single-screw ships is steadily increasing. This is very important in view of the large number of conversions from single-screw steamers to single-screw motor-power that is likely to take place in the very near future.

When we were in Göteborg in 1919, we were advised by Mr. Tadge Madsen, superintendent-engineer of the Transatlantic Steamship Company of that city that his company proposed to convert their single-screw vessel "Bolmen." An order was placed for this engine with the Atlas Diesel Motorer of Stockholm, builders of the well-known Atlas-Polar two-cycle marine Diesel engine, and who are associat with McIntosh & Seymour of Auburn, N. Y. However, it was afterwards decided to build a new single-screw motorship of 4,000 tons d.w. and install the Atlas-Polar engine in the same. So an order for the hull was placed with Götaverken of Göteborg, and the vessel will be launched next autumn. Götaverken are also building a B. & W. Diesel engine for another single-screw motorship, also for the Transatlantic Co.

We are enabled to illustrate the Polar Diesel engine which has a bore of 600 mm. (23-622") by 900 mm. (35-433) stroke and turns at 90 r.p.m. developing 1200 shaft h.p. or 1700 i.h.p. But, the Atlas Company have developed a new 6-cylinder engine with a bore to stroke ratio of 2 to 1 and of 1,100 to 3,000 i.h.p. at engine speeds varying from 125 r.p.m. from the smallest size to 80 r.p.m. for the big models.

The cylinders and pistons are of the step-type, the lower-pistons forming the scavenging air-pump and is also used as an air-engine when starting or maneuvring. This means that there is only one valve in the head of the working cylinders, namely for the injection of fuel. Additional scavenging-air is supplied by a double-acting auxiliary scavenge pump driven by links and rocking-levers from one of the crossheads. It is mounted on one of the engine-frames and has automatic valves. Part of the frame of the engine is used as a receiver for the scavenging-air. For auxiliaries in the motorship there will be three sets each consisting of a two-cylinder, four-cycle type Polar Diesel-engine of 60 h.p. at 300 r.p.m. connected to a direct-current electric-generator of 220 volts. Three of these sets will be installed.



The 1,700 I.H.P. Atlas-Polar two-cycle Diesel engine for one of the Transatlantic Company's new single-screw motorships building at the Götaverken

M.S. YEARBOOK FOR 1922

Every motorship engineer should possess a copy. The cost is only $2.00, bound in cloth.

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Wilhelm Wilhelmsen's new Burmeister & Wain motorship "Teneriffa." She is the first Diesel ship built at the B. & W. yard to have a stack

Motorships "Thalatta" and "Teneriffa"

Two of Wilh. Wilhelmsen's New Big Diesel-Driven Freighters

BUILT to the order of the Norwegian, African and Australian Line, of Tonsberg, Norway, the cargo motorship "Thalatta," sister to the new motorship "Teneriffa" of the Mexican Gulf Line, was launched on May 6th, at the Burmeister & Wain shipyard, Copenhagen, Denmark. Both these ship lines are Wilh. Wilhelmsen concerns. The "Teneriffa" was recently delivered to her owners, having run trials on May 3rd.

The "Thalatta" and the "Teneriffa" have the following dimensions,

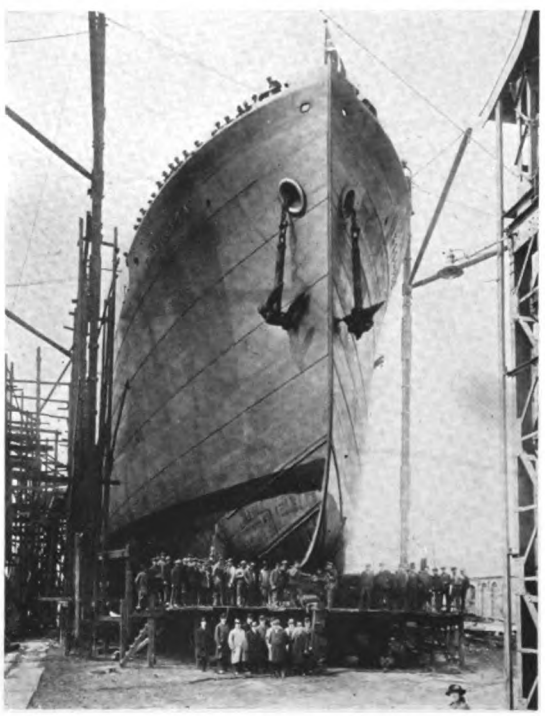
Displacement, loaded	15,025 tons.
Length B. P.	425′ 5½″
Breadth	55′ 0″
Depth	38′ 6″
Deadweight	10,875 tons.
Power	3,400 I.H.P. or 2,400 s.h.p.
Loaded Speed (26′ 5″ dft)	11¼ knots
Daily Fuel-consumption	10 tons.
Engine Speed	125 R.P.M.

She is a twin-screw vessel and is propelled by two six-cylinder Burmeister & Wain Diesel-engines of 1,500 i.h.p. each. A few—but especially well-equipped — passenger-rooms are arranged for. All the engine-room auxiliary machinery as well as the deck machinery, such as winches, steering-engine, etc., are electrically driven. Electric light is installed throughout.

It is interesting to note that unlike the majority of Burmeister & Wain-built vessels the "Thalatta" is fitted with a stack which is used for housing service water tanks heated by the exhaust gases. The engine is of the Burmeister & Wain four-cycle type with 6-cylinders 630 mm. bore (24.803″) by 960 mm. stroke (37.795″) and are designed to develop 3,100 i.h.p. or 2,400 shaft h.p. at 125 R.P.M. On trials over the measured-mile the vessel displaced 4,892 tons and the draught averaged 10′ 4¾″. Her speed averaged 12.29 knots, the engines together developing 3,383.8 I.H.P. at 138.4 R.P.M.

During the consumption-test the main-engines developed 3,254.49 I.H.P. at 134.6 revolutions per minute, at a fuel oil-consumption of 0.2973 lb. per i.h.p. hour, the net calorific-value of the oil being 10,250 kg. (18,450 B.T.U.). This included the consumption of auxiliary Diesel-engines producing the necessary current for the auxiliary-machinery, steering-gear and electric-light.

The machinery is placed amidships, and for the loading and unloading of the cargo there are five cargo-hatches, served by 12 winches. The 5-tons after winch has warping-ends arranged on an extended-shaft to serve also as warping-winch. All auxiliary-machinery in the engine-room as well as the deck-machinery is electrically-driven, the necessary current being supplied by three 60 K.W. Diesel-electric generators. The equipment includes a Thomas B. Sabroe refrigerating set for the provision store. A third vessel of practically the same tonnage will be launched for this owner from the Burmeister & Wain yard in several months, and eventually will be operated by the Norwegian-Mexico Gulf Line.



11,000 tons motorship "Thalatta" just prior to her launch at the Burmeister & Wain yard, Copenhagen. She is the second of the three Diesel ships for Wilhelm Wilhelmsen and will be run in his Norway, Africa, Australia line

VENTILATING SILENCERS FOR MOTORSHIPS

Regarding the drawing of the water-cooled valve silencer and the air-cooled funnel ejector-silencer illustrated on page 286 of the April issue of "MOTORSHIP," it should be made clear that these are two distinct devices. Incidentally, the words "5 ft. pairs" in various places should read "5 ft. fans" and in the next sentence the word "renewals" should read "overhauls." Mr. Martin the designer, states that "the exhaust enters directly from the engine manifold into the baffle chamber in the stack through one or more very light disc-valves which float as it were on these escaping gases, thereby maintaining the velocity of the gases substantially constant, the lift of the valve being proportional to the volume of gases passed; after which this constant velocity gas flow can act efficiently as an operating agent for the air ejector and cooling silencer in the funnel if needs be. This exhaust-gas cooling air can be taken from motor-room, and thus act as ventilator as shown on left-hand figure. The right-hand figure, however, shows a water-cooled silencer valve which takes the place of the usual bulky silencer and is fitted directly to the manifold; the cylinder cooling-water is used to keep the valve slightly submerged.

"The escaping gases lift this valve, which has a light spring to ensure its closing when engine is at rest. The gases escape radially outwards from the valve orifice in a discular shape between two annular guide surfaces, and in so doing draw the surrounding water with them ejectorwise, which energetically cools them. Their power for producing noise is expended on setting this water into motion, which flow in fact helps to withdraw these gases and lessens the back pressure very materially."

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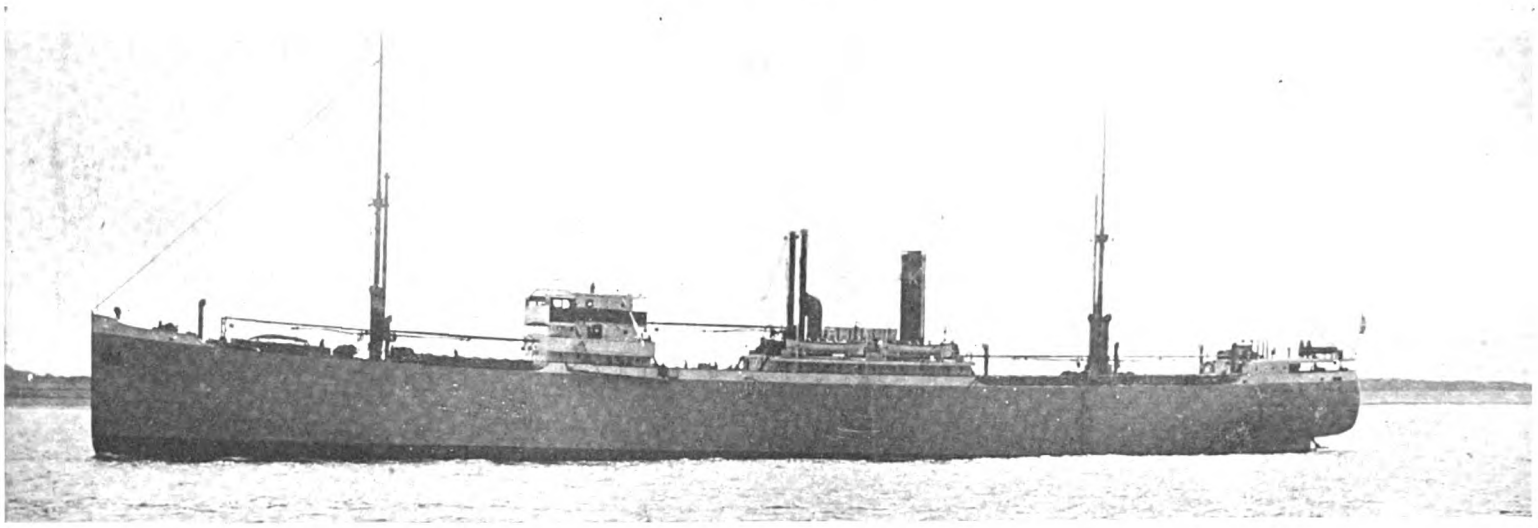


New Werkspoor Diesel-engined twin-screw motorship "Hallfried," owned by P. Kleppe & Co.

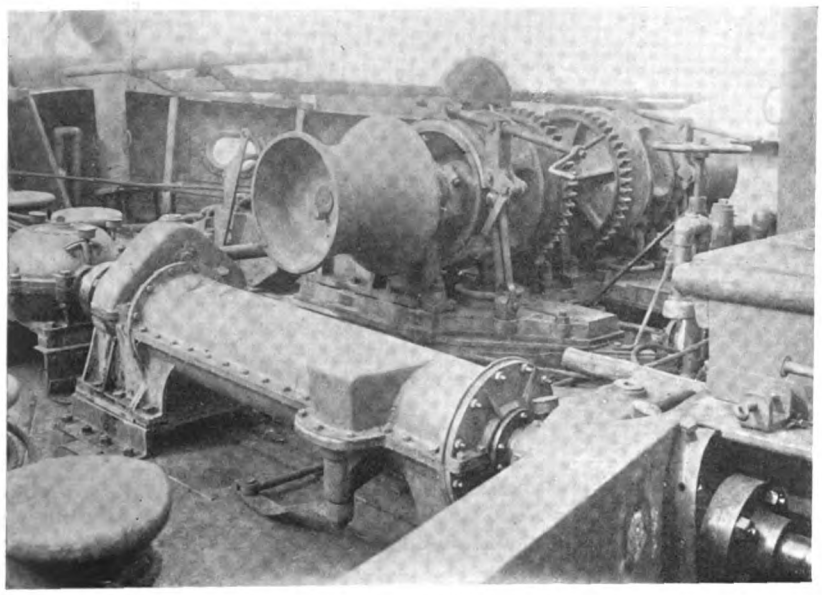
Trials of Motorships "Rhea" and "Hallfried"

Two New Werkspoor Diesel-engined Freighters

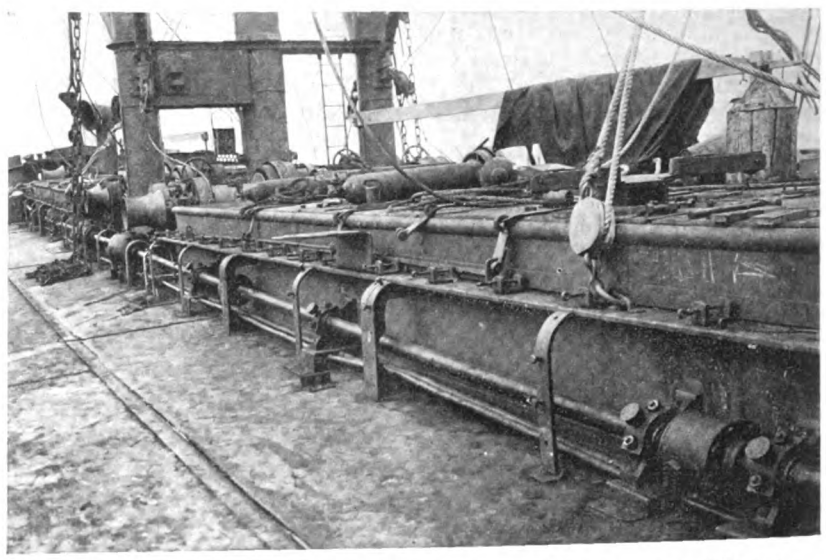
Recently trials were run in Holland of the new Werkspoor Diesel-engined freighters "Rhea" and "Hallfried," which vessels were previously described in "MOTORSHIP" and are listed under No. 667 and 702 in the MOTORSHIP YEARBOOK for 1922. The "Rhea" is owned by the Royal Netherlands Steamship Company of Rotterdam, and was built by Bodewes Bros. of Lobith, Holland, and is of 2,250 tons d. w. She is a single-screw vessel propelled by a Werkspoor four-cycle Diesel-engine of 825 shaft h.p. at 130 R.P.M.

As will be seen from the illustrations, the auxiliaries differ in some respects from the general practice, the electrical system not having been adopted. Steam is supplied by two oil-fired donkey-boilers when in port, but at sea sufficient heat is secured from the exhaust-gases of the main engine for operating the steering engine, heating and lighting. The usual run of steam winch has not been adopted for handling cargo, the power being supplied by shafting along the deck, the shaft itself being driven by a uniflow steam-engine down in the engine-room. The winches may be coupled independently by means of friction clutches.

The motorship "Hallfried" is a twin-screw vessel of 7,200 tons d. w. propelled by two Werkspoor 1,000 shaft h.p. Diesel engines. She is owned by P. Kleppe & Co., Bergen, Norway, and was built by L. Rijke of Rotterdam, Holland. After successful trials both motorships entered the new waterway together, a unique event in motorship history.



Anchor-windlass of the motorship "Rhea," showing the friction clutches and central driving shaft



Shaft for driving winches and anchor windlass of the motorship "Rhea"

The single-screw Werkspoor Diesel-engined motorship "Rhea," owned by the Royal Netherland Steamship Co.

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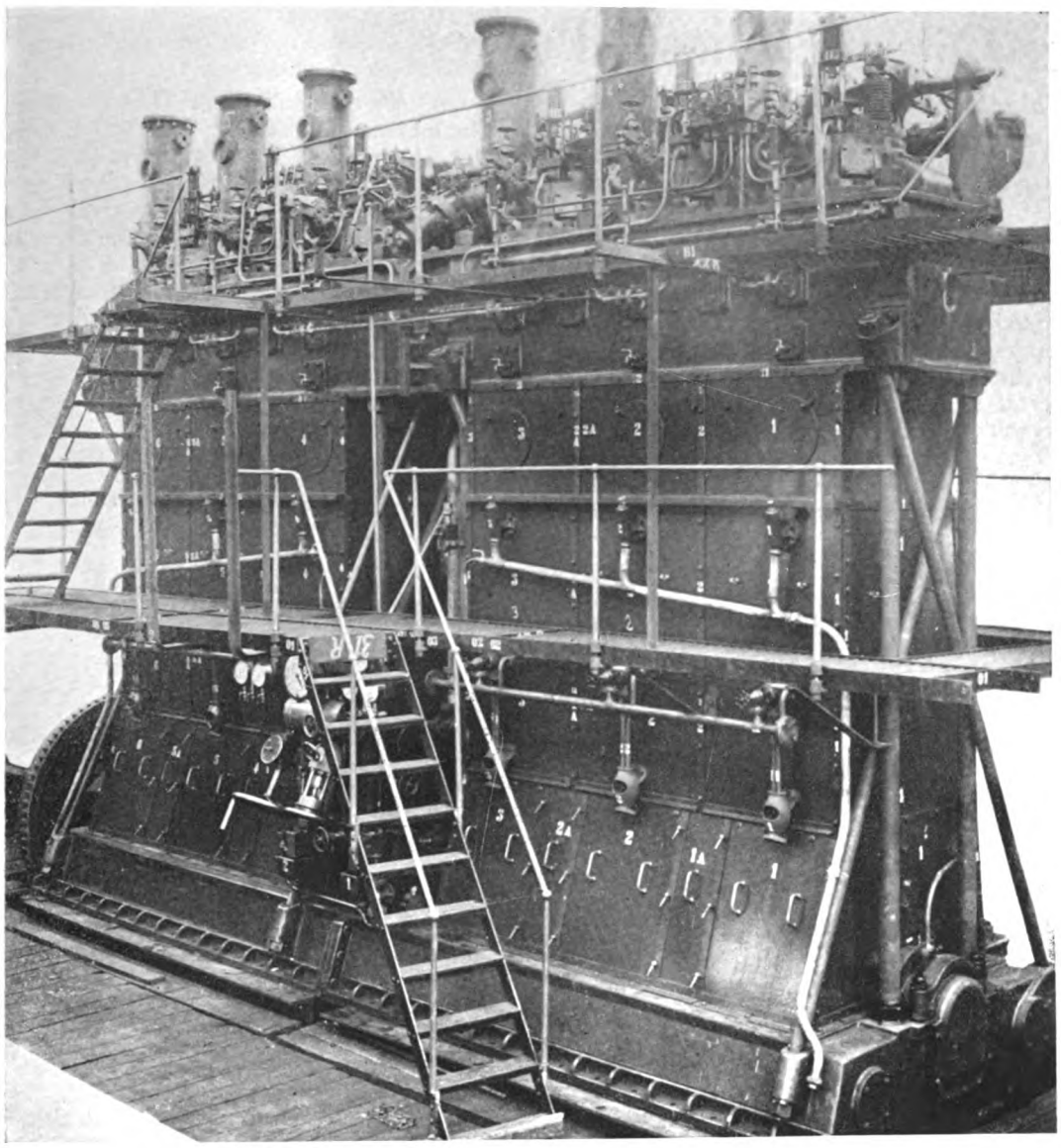


The 1,100 I.H.P. Werkspoor Diesel engine installed in the single-screw motorship "Rhea"

DEMISE OF CHAS. G. ROBERTON

It is with deep regret that we learn of the death from pneumonia after a few days illness of one of our keenest readers in Great Britain, namely, Charles G. Roberton, O.B.C. of Vickers Ltd. of Barrow-in-Furness, England. Thus fate cut short what was a very distinguished engineering career. Mr. Roberton had been engaged in Barrow for about 32 years—including previous to the advent of the Vickers Company. He occupied an important position in Vickers Marine engineering drawing office, afterwards becoming Marine-Engineering Manager, and finally became the firm's expert in internal-combustion-engines. He was largely responsible for the development of such engines from gasoline to the heavy-oil type for submarines and other Government and mercantile vessels.

The late Chas. G. Roberton of Vickers, Ltd.

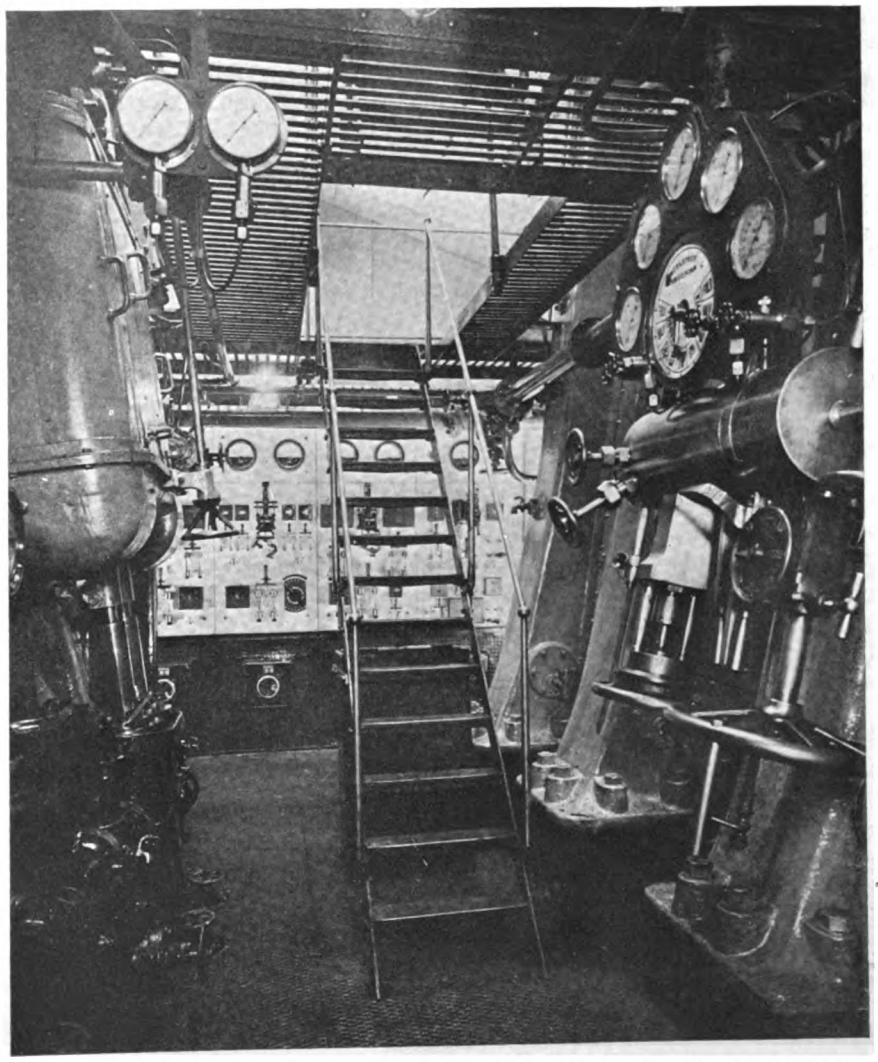
He was very intimately associated with the early development of airships in his country, and was a man of very considerable ability and inventive genius. Though chiefly interested in the development of mechanical engineering he had a wide and versatile knowledge of kindred scientific matters. His charming personality rendered him very popular amongst all who had the privilege of working under him, and those that knew him best will mourn his loss as that of a very sincere friend. The accompanying portrait was taken while he was aboard the motor-tanker "Narragansett" during an inspection visit.

BETHLEHEM DIESEL ENGINE PLANS

While a number of modifications have been made to the main Bethlehem-West 2,500 shaft h.p. two cycle Diesel engine of the ore-carrier "Cubore," principally to the auxiliary machinery, we understand that this vessel has been in fairly consistent operation, giving as good service as may be expected from the first engine of this particular design, especially as the six-cylinders each have an output of 416 shaft h.p. or 500 i.h.p. which is a greater power and at lower engine revolutions than the cylinders of the big Diesels of the Glen Line, Holland-American Line, Elder-Dempster Line, and the Royal Mail Line 14,000 ton 13 knot motorships.

Considerable experience has been gained from the operation of the "Cubore," which is a single-screw ship, which naturally has been embodied in the second Bethlehem engine now on the test bed at South Bethlehem, Pa.

Mr. J. J. Tynan, General Manager of the Bethlehem Shipbuilding Yard at Alameda, states that if no further changes are necessary to the design they will immediately start construction on the Pacific Coast, the Alameda plant having been originally laid-out with a view to constructing Diesel engines eventually.



Control station of the engine-room of the motorship "Hallfried." Note the cast iron columns of the twin Werkspoor engines. In this case the cast iron columns are arranged at the front of the engine, whereas on the "Rhea" the cast iron columns are at the back and are not shown in the other illustration

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Boiler-Oils for Diesel Power

Valuable Development Work in the Use of Fuel-Oils for Motorships Carried-Out by The Texas Co.

*By L. B. JACKSON, M. E.

DURING the past few months many articles and editorials have been published in technical journals or magazines, both in this country and in Europe, which dealt with fuel-oils for motorships. In practically all of these articles the term "boiler-fuel" is used to qualify the oil used for fuel, and usually is considered as applying to oils ranging from 20° to 14° Baumé. To compare results of test-block or sea trials held at different places, at different times, is thus impossible, even though the balance of the given data is most complete. As the term "boiler-fuel" is indefinite, and can be used (correctly) to describe oils of greatly differing characteristics, we should endeavor to grade the oils by the characteristics which most effect in their use as a motorship fuel.

In this country oils are generally classed according to degrees Baumé, whereas in Europe the specific-gravity is the most used term; whichever is used is immaterial in that they are readily interchangeable. The important fact, however, is that the gravity is *not* the determining characteristic. The Baumé gravity of water is 10°, yet as far as atomization is concerned, and atomization is the determining characteristic, it is ideal. Oil of 10° Baumé is difficult to atomize and the difficulty is due to its high viscosity.

The different oil companies market their fuel-oils under various trade names and the specifications are quite broad in regard to limits of gravity and viscosity. This is due to the fact that the oils vary considerably in the different producing fields and the fuel oil will, in consequence, vary according to its origin. Under these conditions it is impossible to give data that will apply to *all* fuel-oils. However, in order to clearly show certain relations, the accompanying curves have been prepared. They are approximately correct for a large percentage of fuel-oils.

In that both "Baumé Gravity" and "Specific Gravity" are used frequently and have a definite relation, the curves have been plotted with both as abscisæ, the Baumé degrees at the top and the corresponding specific gravity at the bottom. For similar reasons both the b.t.u. per pound and per gallon are given, although having one it is very easy to determine the other. The general practice in this country is to use the Saybolt-Universal scale to denote the viscosity of the lighter grades of oil and to use the Furol scale for the heavy oils. To eliminate the possible confusion which might arise by using different scales, and at different temperatures, in the same article, the viscosity is shown for all grades on the Saybolt-Universal scale at 100° F. The curve showing percentage of sulphur should be clearly understood. This curve does not show *average* sulphur content, but shows *maximum* sulphur likely to be found. Most fuel-oils, particularly in the range of from 25° B to 10° B would have a *considerably lower* sulphur content. Other than calling attention to rapid increase in sulphur content between 22½° B and 15½° B no comments are worthy of noting as it is very questionable if the sulphur content will have any marked effect upon operation of either two or four-cycle Diesel engines.

A casual glance at the curves shows clearly that the gravity is a poor term to use relative to an oil's suitability for Diesel engine use. The increase in viscosity from 35° B to 20° B (fifteen degrees) is only one-twelfth the increase from 20° B to 15° B (five degrees); the increase from 15° B to 13½° B (one and one-half degrees) is equal to the increase of the five degrees from 20° B to 15° B. In other words, the *average* rate of increase per degree for the one and one-half degrees between 15° B and 13½° B is 120 times as great as the *average* rate per degree in the fifteen degrees between 35° B and 20° B.

It should also be noted that as oil is generally purchased by volume (barrels or gallons) and not by weight (tons or pounds), that a greater amount of b.t.u.'s are secured in the same quantity of fuel, when heavy grades are purchased. As the horsepower developed in a Diesel engine is practically proportional to the b.t.u. input we are justified in expecting a greater horsepower per gallon of fuel used, or a reduced fuel consumption per day, which expectation has been realized in actual experience.

As the modern mechanical fuel-oil burner being used under boilers will handle fuels as low as 10° B, and as cost of fuel increases with increase in degrees Baumé, steamers will use for fuels principally oils under 16° B. It would therefore appear, to the writer, that a Diesel engine manufacturer is not justified in claiming his engines will operate on "boiler-fuel" unless his engine will run satisfactorily on these lower grades.

Since the latter part of September, 1921, the motor-tanker "Solitaire" of the Texas Company's fleet of tankers, has been operating on heavy fuel. The "Solitaire" is of approximately 4,700 deadweight tons and is propelled by two McIntosh & Seymour Diesel engines. The grade of fuel used is the Texas Company's Bunker "C" oil.

For the dock trials and trial trip from Bath, Me., to Port Arthur, Texas, the oil used analyzed as follows:

Gravity Specific	0.9685
Gravity Baumé	14.5°
Sulphur	4.365%
Viscosity (Say. Univ. 100° F)	6000 sec.

Before proceeding with the discussion of the installation, and the operation of the engines on Bunker "C" oil, we should observe the effect upon the viscosity which may be pro-

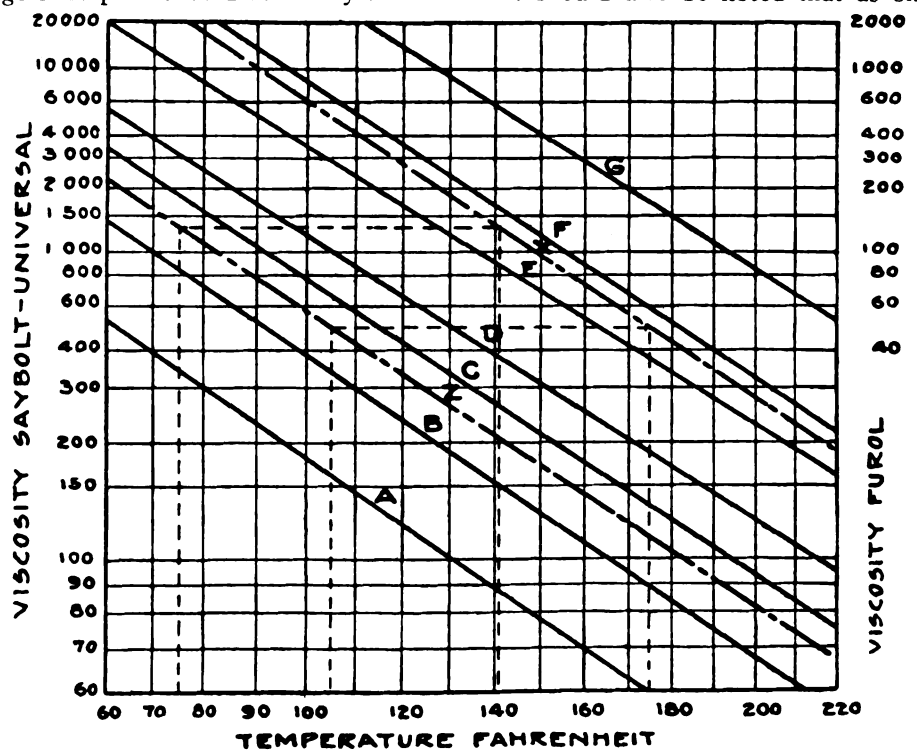

Fig. 2

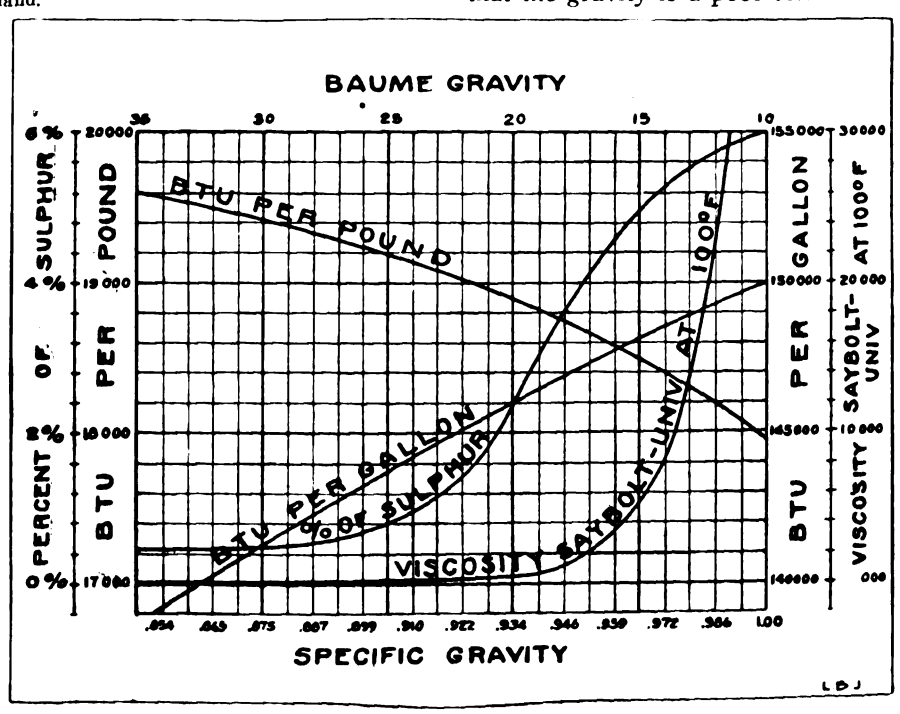

Fig. 1

* Member:—A. S. M. E., So. N. A. & M. E., D. E. U. Asso., England.

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duced by changing the temperature of the oil. This is clearly shown in Fig. 2, which is reproduced from the September, 1921, issue of *Lubrication*. The viscosity of the oil used, as previously stated, was 6,000 at 100° F. If through the point of intersection of a horizontal line drawn through the 6,000 viscosity scale and the vertical line drawn through the 100° temperature scale, we draw a line "X" parallel to "F," we have a line which will enable us to closely determine the effect of temperature upon this particular oil. The heaviest oil used by the "Solitaire" before heating system was installed had a viscosity Say. Univ. 100° F. of 575 sec. In the manner described above we obtain the line "Z" which gives the viscosity change, in this oil, produced by change of temperature.

The lowest temperature at which this oil could be used was 75° F. Thus to determine the lowest temperature at which this heavy oil could be consumed, we have but to draw a horizontal line from the viscosity at 75° F. or line "Z" to line "F," which gives the temperature, 141° F. at which the heavier oil has the same viscosity as the lighter oil at 75° F.

The temperature of the oil for the dock trials and the first few trips averaged about 140° F. However, the oil did not flow as freely as desired, therefore to overcome this difficulty new atomizer burner plates were used with 10% more area in the orifices. Later on some modifications were made in the heating system and the temperature of the oil was increased to 175° F., at which point the viscosity is approximately 500 sec., which is only 37% of the viscosity at 141° F. After this modification in the heating, with its resultant lowering of the viscosity, the original burner plates were tried out and found to be perfectly satisfactory.

When the engines were installed in the "Solitaire" no thought had been given as to desirability and practicability of using heavy boiler fuels. Samples of the fuel we expected to use had been submitted to the engine builders, who assured us that the oil was entirely satisfactory. This oil had a viscosity of about 180 sec. at 100° F. and a sulphur content of about 0.8%, the Baumé gravity being 22.6°.

After the vessel had been in service slightly over a year it was decided to make some experiments to determine how the engine would function on high viscosity oils. A preliminary

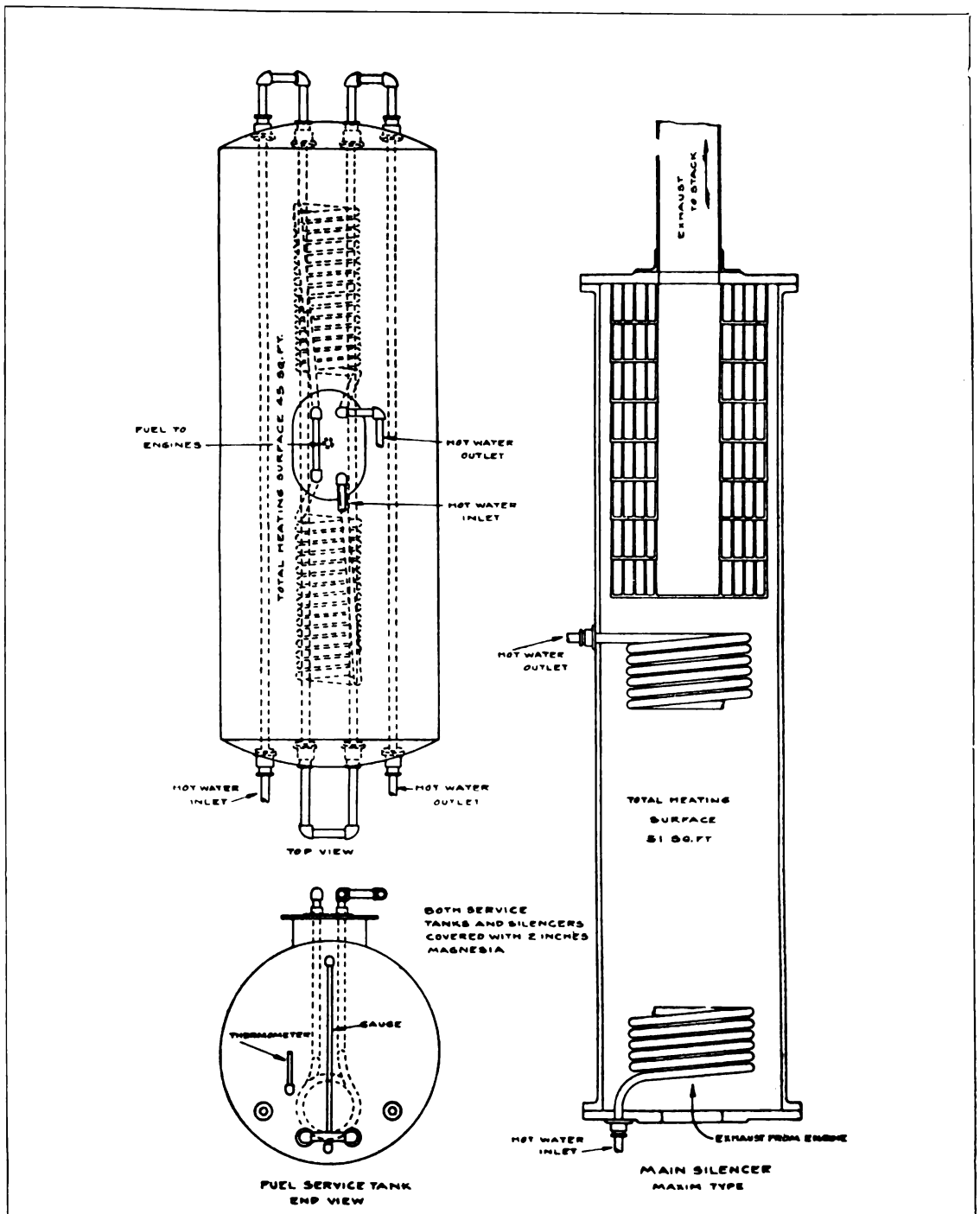

Fig. 4.—Showing arrangement of special coils in the silencer

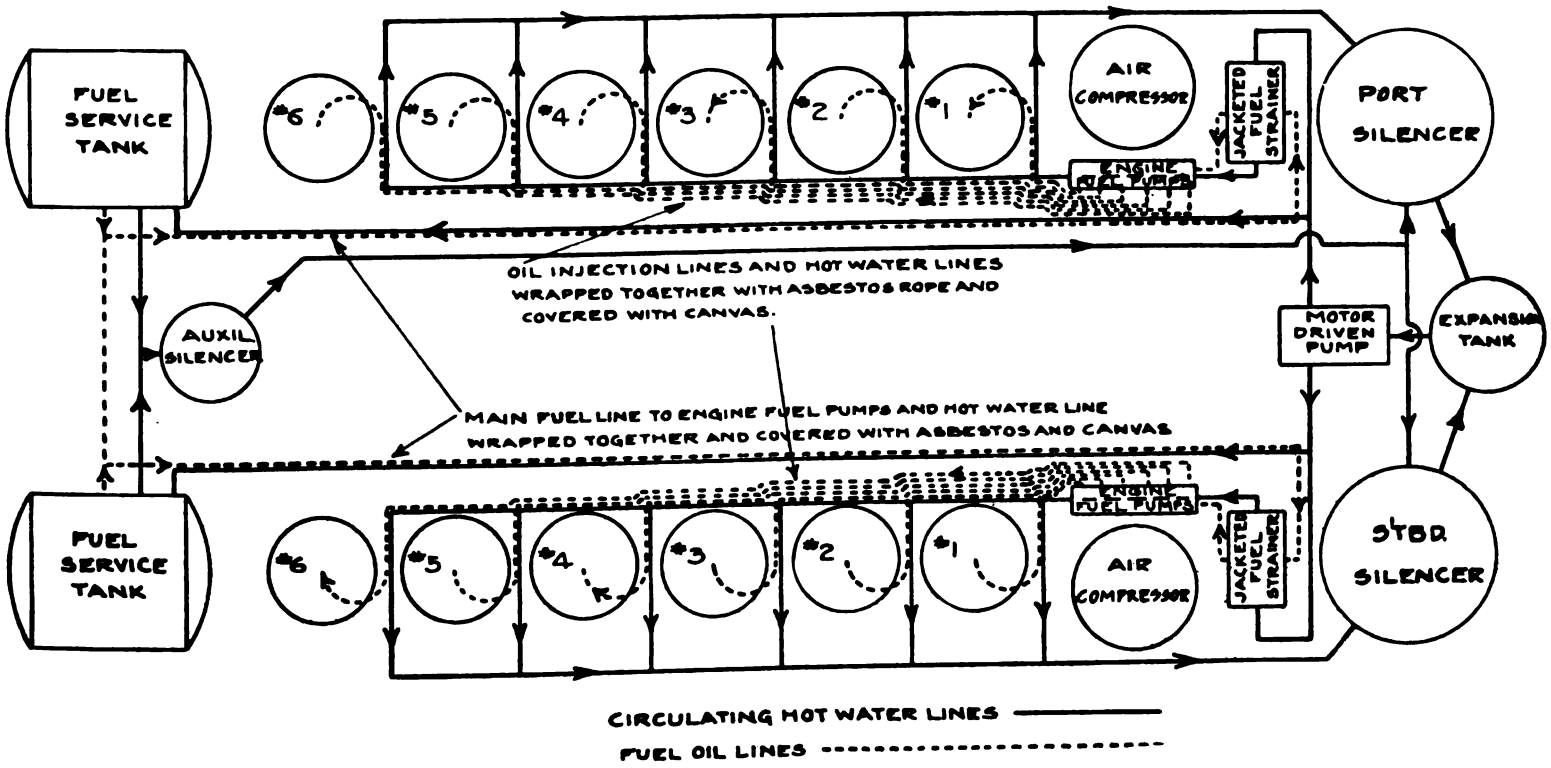

Fig. 3.—DIAGRAMATIC LAY-OUT M.V. "SOLITAIRE" FUEL OIL HEATING SYSTEM

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study of the subject convinced us that the whole proposition was nothing more than the question of how much heat would be required to lower the viscosity of the oil we desired to use to that of the oil we were then using, and also what was the best way to secure the necessary heat.

Knowing the approximate temperature required to get proper viscosity, it was apparent that steam would not be necessary for heating the fuel, which simplified the installation problem, for the "Solitaire" was not equipped with a donkey boiler. As radiation losses could not be determined exactly, and as quick heating was to be desired, it was decided to install the maximum possible heating surface. The heating system is very simple (see Fig 3), consisting of spiral coils in the main exhaust silencers (see Fig. 4), through which *fresh* water is circulated and then discharged into an expansion tank, vented to atmosphere. A motor driven simplex pump draws the water from this tank and forces it through coils in the daily service tanks (see Fig. 4), through coils around the suction pipes in main bunkers, through jacketed strainers at engine pumps, and then through coil in auxiliary exhaust silencer, after which the cycle repeats.

The fuel oil lines from the service tanks to the jacketed strainers parallel the hot water lines from the pump to the service tanks. To minimize temperature drop in the oil, after leaving service tanks, these lines are wrapped together and lagged with magnesia. In the original installation a branch hot water line paralleled the fuel oil lines from the engine pumps to the atomizers, and jacketed strainers were not used. When the water-jacketed strainers were installed the discharges from the strainers were led through these lines and returned to the silencers. The addition of these strainers was referred to in a previous paragraph, where it was mentioned that viscosity was further lowered by raising the oil temperature from 140° F. to 175° F.

As the use of heavy oil was an experiment it was decided that the installation should be such that if any difficulties were encountered the engines could be immediately switched over to low viscosity oil. With this idea in view, the timing of the injection of fuel was not changed nor was the compression altered. After a few trips had conclusively shown that the engines could be operated satisfactorily on high viscosity oils, a number of minor alterations and adjustments were made to try to secure an even better economy and increased maneuvering powers. Experiments showed that by increasing the compression fifteen pounds per square inch, advancing time of injection two degrees, increasing temperature of oil, and raising the circulating water discharge temperature to 125° F. fuel consumption could be reduced and engines run at a considerably lower r.p.m.

While repeated tests have demonstrated that the engines can be reversed from "full-ahead" to "full-astern" in the same period of time, irrespective of whether high or low viscosity oils are being used, it has been found advisable to carry a small amount of low viscosity oil for starting up when cold and for use at dock previous to "finished with engines" signal. This is readily understood by reference to viscosity temperature lines; when engines are shut down the oil temperature in the lines from engine pumps to the atomizers may drop to a point where the viscosity would be so high that the oil would become almost solid and make starting up again a slow process. For the same reason, in a fog or approaching an anchorage the engines are switched over to low viscosity oil.

As previously mentioned, the oil used has had a sulphur content of as high as 4.365%. A careful observation of valves, verified by analyses of deposits scraped off valves and stems has convinced us that the sulphur content is relatively of no importance.

By the use of high viscosity oils, which cost less per gallon, the total fuel bill will be proportionately reduced provided the consumption remains constant. The latter, however, has not been the case as the actual consumption has been 8% lower, the cargo carried and sustained sea speed remaining the same. This 8% reduction is due to three causes: first, the high viscosity oil contains a greater number of b.t.u. per gallon; second, by heating the oil 110° above normal the b.t.u. input to engine is increased; third, engine adjustments are maintained with higher accuracy.

The last item in above paragraph merits further consideration. The same engines using a low viscosity oil would not, of necessity, need to be kept in as perfect adjustment, *i.e.*, engines would run along smoothly if compression dropped forty pounds per square inch, also circulating water discharge could vary from 90° to 125° F. without much effect. This ability to run satisfactorily when engines are not kept properly tuned up has a tendency toward making engineers careless. Where high viscosity oils are used the opposite is the case; the compression pressure must be kept right and the circulating water temperature must be regulated closely or the engines will smoke and the top piston rings carbonize. Thus the engineers, realizing that continuous watchfulness while on watch will mean less frequent drawing of pistons and cleaning of valves, choose the less arduous of the two courses and keep the engines at all times in top notch condition.

Up to March 7, 1922, the "Solitaire" had covered 26,335 nautical miles since starting to use the high viscosity oil. The elapsed time for this period was 166 days, therefore at this rate the "Solitaire" would make 58,000 miles per year. These figures are mentioned simply to show that, although the installation was an experiment, the vessel has not been delayed at either sea or in port.

As a result of experience to date we have determined to our own satisfaction that the Diesel engines in this vessel can use high viscosity oils with complete satisfaction. That these engines have demonstrated their ability to use oils of this type does not prove that all four-cycle engines, as at present built, can do likewise, but it does indicate that this type of engine, irrespective of by whom built, can be adapted to use high viscosity oils.

It should be noted also that the main bunkers of the "Solitaire" are "deep tanks." In ships where bunkers are carried in double bottoms, the heat requirements would be much greater and a donkey boiler would be required, which would materially reduce the saving made by the engine. It thus becomes apparent that not only the engines must be considered, but also the hull itself in regard to location of bunker tanks. Furthermore, the trade route has an effect upon the saving, particularly when fuel is carried in double bottom tanks. With the sea temperature in the Gulf of Mexico of 78° F. (winter) considerably less heat is required than is the case in the North Atlantic (winter) when sea temperature may be 33° F.

To briefly summarize: the results of the "Solitaire's" performances demonstrate that a four-cycle Diesel engine, with air injection, can operate satisfactorily on high viscosity oils, producing a considerable reduction in the fuel cost, and without increasing maintenance costs or lowering operating efficiency.

REVIEWS

The Port of Portland, Maine. Port Series No. 1. Prepared by the War Department, Board of Engineers for Rivers and Harbors, 64 pages with maps and illustrations. Government Printing Office, 1921. The first of a series of volumes which will contain full information regarding about 70 ports of the United States has been published by the War Department in cooperation with the Shipping Board. Many of the chief obstacles in the way of more efficient shipping methods and continuous movement of freight are to be found in the ports, where congestion, poor docking facilities, lack of railroad terminals and other physical limitations prevent commerce from developing as it should.

This condition has in many cases become serious and the Shipping Board and the War Department are utilizing the mass of data relative to each port which these departments have, making a complete study of each port and incorporating all this data together with Army Air-Service aerial photographs, etc., in a volume covering each port. In each are described location, port and harbor conditions, regulations and charges, terminal data, dry docks, repair facilities for vessels and machinery, grain elevators, coal and bunkering facilities, storage warehouses, floating equipment, wrecking and salvaging services, steamship and railroad lines serving the port.

Based upon results of this study of physical and economic conditions, recommendations are outlined for changes as may seem desirable in order to enable the port to function to best advantage. Judging this series on ports by the first volume, we feel that when this information relative to the national transportation system is in the hands of those most interested that action will be taken to remedy the defects which now hinder and producer, carrier and consumer will be greatly benefited.

Worthington Instruction Book for Centrifugal Pumps. A hand book for operating engineers issued by the Worthington Pump & Machinery Corp., New York City. This 72-page booklet should be in the hands of every engineer having pumps in his care. Not only are there many pages covering in detail the centrifugal pumps manufactured by this concern, with instructions for installation and dismantling, but much information and data relating to water temperatures as effecting suction lifts, velocities, friction, capacities, etc. Much of this matter has never been published before. Readers of MOTORSHIP may obtain copies from the Worthington company.

Diesel and Semi-Diesel Engines. Brochure issued by Prices' Company, Ltd., London, England, with twelve pages of appended notes on the Lubrication of Marine motors for auxiliary craft. To those who are interested in having a concise history of Diesel and surface-ignition oil-engine development this little two-part brochure is recommended. Correct methods of lubrication of various parts of oil-engines, recommendations of the best grade of oil produced by Prices' Company Ltd. (which, by the way, is we believe the pioneer concern engaged in lubrication of oil-engines) for various makes of oil-engines completes this book, which will be mailed to any interested reader upon referring to this review.

PURCHASE TWIN 500 B.H.P. DIESEL ENGINES

Two 500 b.h.p. McIntosh & Seymour Diesel engines have been purchased by the Pacific Spruce Corp., Northwestern Bank Bldg., Portland, Ore., from the Paterson-McDonald Co. No information is yet available as to what vessel will have these engines installed.

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New Single-Screw Diesel Freighter Visits New York

Record of Performance of First Long-Stroke B. & W. Diesel Engined Motorship "Leise Maersk" on Her Maiden Voyage

UNDOUBTEDLY great interest is attached to the maiden voyage of the Danish motorship "Leise Maersk" because of the fact that this vessel has made a voyage around the world driven by the first long-stroke Diesel engine which Burmeister & Wain built at Copenhagen. MOTORSHIP in the October, 1921, issue (pages 803 to 805) described quite fully the ship and her machinery. To repeat a few of the principal particulars we will mention that the "Leise Maersk" is of the following dimensions:

Loaded Displacement	6,350 tons
Dead-Weight Capacity	4,440 tons
Net Cargo-Capacity	about 3,850 tons
Cargo-Capacity of Holds (bales)	210,200 cu. ft.
Stipulated Sea-Speed	10½ knots
Daily Consumption of Fuel	4½ tons
Total Fuel and Stores Carried	580 tons
Fresh-Water Capacity	20 tons
Engine-Speed	80 to 100 R.P.M.
Power of Main-Engine, 1,500 to 1,750 i.h.p. (1,150 shaft h. p. at 80 R.P.M.)	
Length (O.A.)	315 ft., 3 in.
Length (B.P.)	299 ft., 6 in.
Breadth (M.D.)	44 ft.
Depth to S. D.	28 ft., 11 in.
Draught Loaded	22 ft., ½ in.
Weight of machinery including all equipment and shafting	332 metric tons
Length of Machinery Space	42 ft.

The "Leise Maersk" loading Russian Relief Cargo at New York for Black Sea Ports

A description of the new long-stroke Diesel engine built by Burmeister & Wain appeared on page 216 of the March, 1921, issue of MOTORSHIP, and it is unnecessary to repeat at this time a description of the design of this engine.

The "Leise Maersk" was constructed by the Odense Shipyard, Odense, Denmark, for the Svendborg Steamship Co., of Copenhagen, which are A. P. Möller companies. As previously mentioned in MOTORSHIP, she ran her trial trip on Sept. 2, 1921. On this trial four runs were made, the ship being light at a displacement of 2,240 tons and a mean draft of 8′ 2½″. An average of 1,665 h.p. at 91.9 R.P.M. was attained, the ship averaging 11.71 knots. With the engines developing 1,710 i.h.p. at 92 R.P.M. a speed over the measured mile of 12.6 knots was attained, the fuel-consumption being 0.1265 Kg. per i.h.p. hour when the engine was developing 1,565 i.h.p. at 88.9 R.P.M.

Evidence that the motorship has, even on such a first installation of an engine of a certain type, developed to a point where operation is satisfactory is evident from the fact that the "Leise Maersk" sailed on her maiden voyage on Sept. 4th., simply requiring time enough to take the crew and stores aboard.

The first port made was Aahus, Sweden, to which port the "Leise Maersk" proceeded in ballast at maximum and average speeds of 12 and 11.2 knots respectively, the revolutions averaging 90 R.P.M. over this distance of 120 miles. A cargo of about 3,000 tons was loaded for delivery in Java and the "Leise Maersk" left Sept. 9th, 1921, proceeding via Kiel Canal, where 283 tons of bunker-oil were taken on board. This oil was of 28° Baume, 0.887 specific gravity, having a flash point of 88° C. and ignition point of 118° C., calorific value 10,000, viscosity at 20° C. 1.52 and contained practically no water, asphalt or sulphur.

The run to Batavia, Java, was made with only two stops, neither of these because of any defect in the main engine. The first stop was made because of a broken force-feed lubricating oiler shaft and renewal of this shaft required about one hour. A 10-minute stop was made on account of trouble with a split pin in one of the small shafts of an auxiliary air-compressor.

No trouble whatever was experienced with the long-stroke Diesel propelling-engines. This run to Batavia, where she arrived October 20th, is summarized as follows:

Distance	9,050 nautical miles
Time	42 days
Maximum Speed	11 knots
Average Speed	10 knots
Average Revolutions	83 R.P.M.
Fuel consumption per day (all purposes)	4.6 tons (metric)

Discharging part of the cargo at Batavia, the "Leise Maersk" left October 24th for Samarang, Java, a distance of 255 miles, arriving the following day after a run at an average speed of 11.8 knots. The balance of the cargo was unloaded at Samarang, which port she left in ballast on Nov. 2nd for Butaritari, Gilbert Islands, on the way stopping at Balik Pappan, Borneo, for 350 tons (metric) fuel-oil, this being the last supply of fuel taken on board. Particulars of this fuel-oil are as follows:

Specific Gravity at 15° C	0.912
Flash Point	82° C.
Ignition Point	132° C.
Viscosity	30° C. 1.3
Calorific Value	10,000
Sulphur	Practically none
Asphalt	Practically none

The run from Samarang to Butaritari, where she arrived Nov. 18th, was made with two stops—one stop being for one-quarter of an hour on account of water in the fuel-oil, and a stop of about one hour packing a fuel-oil pump on the main engine. This latter stop was the only stop on the whole round-the-world voyage which was made on account of any main-engine trouble whatever. This stop was not absolutely necessary if it had been desired to make the round-the-world voyage without a stop, as the trouble occurred just before making port at Butaritari and the ship could have proceeded without stopping for this repair. In the interests of best operation of the engine it was, however, desired to make this short stop.

The following is an interesting summary of the run to Butaritari:

Distance	4,068 nautical miles
Average Speed	11.24 knots
Maximum Speed	12 knots
Average Revolutions	91 R.P.M.
Fuel-Consumption per day (all purposes)	4.83 tons (metric)

At Butaritari about 3,000 tons of copra was loaded for delivery at London, and the "Leise Maersk" left Butaritari December 10, 1921, arriving at Colon January 9, 1922, after a run of 6,545 nautical miles made without a stop in 30 days. The vessel had not been dry-docked and had been running in tropical waters for several months so that the bottom was very foul, and this, in addition to very bad weather helped to reduce the average speed to 8.9 knots, at which speed the fuel-consumption was 4.7 tons (metric) for all purposes, and the average revolutions were 81 R.P.M., showing as compared to her usual R.P.M. of about 90 that the barnacles and growth on the bottom of the ship was having a bad effect on the revolutions of the propeller and the progress of the ship.

The "Leise Maersk" left Colon the same day she arrived there and made the run to London in 24 days, arriving on February 3, 1922, and discharged cargo—thus ending a trip around the world.

The following is the data for the run from Colon to London:

Distance	4,826 nautical miles
Average Speed	8.13 knots
Maximum Speed	9 knots
Average Fuel-Consumption per day (all purposes)	4.64 tons (metric)

J. V. Nielsen, chief-engineer of the "Leise Maersk"

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From London, after discharging cargo, the "Leise Maersk" proceeded to Barry, England, which port she left February 21, 1922 fully loaded with 4,200 tons of coal for Savona, Italy, where she arrived March 4, 1922. This run is the first made by the "Leise Maersk" in fully-loaded condition. Therefore, the following data is interesting:

Displacement	about 6,000 tons
Maximum Speed	10 knots
Average Speed (on account of very bad weather)	8 knots
Distance	1,946 miles
Average Fuel-Consumption per day (all purposes)	4.60 tons (metric)

After unloading the cargo of coal at Savona, the "Leise Maersk" left March 16th for New Orleans in ballast, arriving there April 7th after covering a distance of 5,637 miles at an average speed of 11 knots on a daily fuel-consumption of 4.58 tons (metric). The average lubricating oil consumption per day for all purposes on the round-the-world voyage was 24 kilos (54 lbs.) but during the latter part of the voyage when the engineers were better acquainted with the engine this consumption was only 20 kilos (44 lbs.) per day. The mean indicated-pressure of this long-stroke Diesel engine is about 6.4 kg. For the world voyage from Copenhagen to London the following figures, which include all fuel and lubricating oil used for every purpose, including loading and discharging of cargo, is interesting, the fuel oil consumption being 530 tons and the lubricating oil consumption 2,628 kilos (2.89 tons). Her four-bladed bronze propeller drives the "Leise Maersk" with a slip varying from minus 4 per cent when in ballast to plus 10 per cent when in average loaded condition.

Cargo was taken on at New Orleans, which port she left April 13th and arrived at Charleston, So. Carolina, April 16th after a run at an average of 12½ knots. This high speed is partly due to the influence of the Gulf Stream in which she ran a considerable distance. Leaving Charleston April 19th she arrived at New York on April 22nd, docking at Martin's Dock, Stapleton, S. I. (New York Harbor). At this port we went aboard, interviewed Chief Engineer J. V. Nielsen and obtained the data which is given in the above account, from the Log Book of the ship. Chief Engineer Nielsen is extremely enthusiastic over this new long-stroke engine in particular and over all Diesel engines in general. Both he and all the engine crew are former steam engineers who have been educated in Diesel engines by the method which MOTORSHIP has always advocated; namely, that of working for a time in Diesel engine shops and then going out on motorships.

The "Leise Maersk" is heated by steam produced by a small oil-burning boiler, but we believe that some type of electric heaters would be more efficient and more economical than the steam radiators and in this opinion we are supported by Chief Engineer Nielsen who is a strong believer in electric-driven auxiliaries of every kind on a motorship.

This leads us to mention that the "Leise Maersk" is completely equipped with Thrige electric-driven winches, there being seven 3-ton derricks served by these winches. The operation of these winches was perfectly satisfactory in every way, both as regards ease of control and quickness in handling loads of all kinds.

The fuel consumption of the electric generating sets furnishing current for electric winches and for electric lighting of the ship is very low, the following data giving some idea of this cost.

When discharging cargo at Batavia and Samarang the fuel used totalled only 2 tons of fuel-oil; while loading cargo at Butaritari requiring 20 days the consumption of fuel for all electricity produced only amounted to a total of 2.4 tons. When discharging cargo at Savona, requiring 8 days, the consumption of fuel-oil was 1.22 tons.

When we were on board the "Leise Maersk" at the Staten Island dock, these winches were busy loading grain and food stuffs of all sorts shipped by the Near East Relief for the Russians. The "Leise Maersk" sailed from New York at the end of April for Black Sea ports.

The satisfactory operation of the "Leise Maersk" and the wonderful performance of her single long-stroke Diesel engine has led Mr. A. P. Möller, managing director of the owners to enter into quite a motorship program, two 7,050 tons motorships now being under construction at the Odense Shipyard in addition to other motorships.

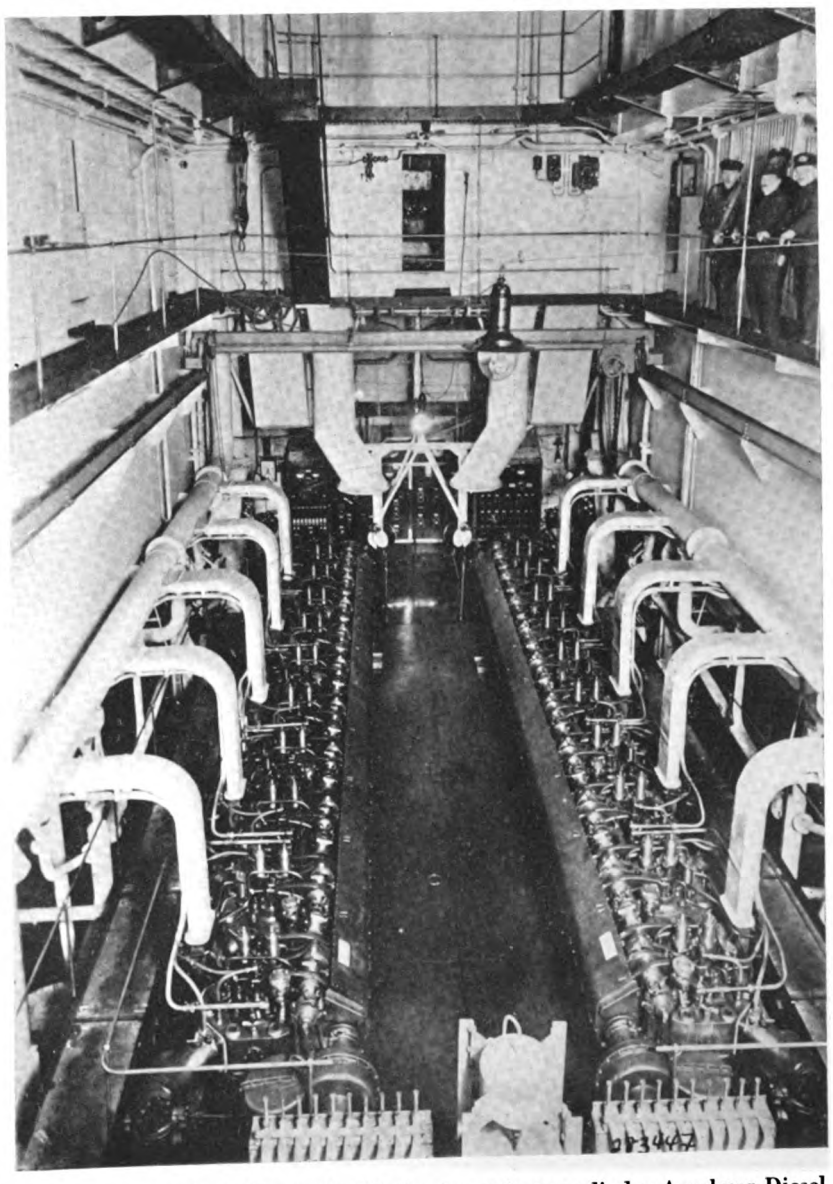
The engine in the "Leise Maersk" is of less horsepower but of the same long-stroke slow-speed type as Wm. Cramp & Sons Ship & Engine Building Co. are now building for the conversion of the Hog Island standard type A vessel which they are now converting to Diesel-power.

It happened that at the same time the "Leise Maersk" was at New York that the "Anna Maersk," a steamship of smaller dimensions but owned by the same company was also in port. After leaving the "Leise Maersk" we went aboard the "Anna Maersk' and the great advantage of a motorship as against a coal-burning steamer was at once apparent, as the steamer was taking on coal and removing ashes and was very dirty because of this work going on.

The engine-room crew's quarters were also very much inferior to those on a motorship, while the crew was larger, considering the horsepower, than that of the motorship. The crew of this little 530 I.H.P. triple-expansion engined-steamer consists of two engineers, one assistant, three firemen and one donkey-man, while the crew of the 1,600 I.H.P. motorship consists of one chief engineer, three assistant engineers, and three oilers, although one additional engineer and another oiler would be an advantage in many ways. On the trip from Aahus to London a guarantee-engineer from Burmeister & Wain was also carried.

Referring again to the steamer "Anna Maersk," which is of 799 tons net and 240′ long, 36′ 6″ breadth and 16′ 9″ depth, we found that the daily fuel consumption of coal varied from 9 to 13 tons according to the quality of the coal and the efficiency of the firemen, or more than double that of the much larger Diesel ship. This variation of consumption of fuel is not present in a motorship, as records of this voyage of the "Leise Maersk" indicate.

When it is remembered that none of the engineers had previously driven a motorship on such a long voyage and that this was the first engine of the new type, the voyage of the "Leise Maersk" will stand as a creditable performance that will increase faith in the reliability of Diesel power.



Engine-room of the "Munsterland" showing twin ten-cylinder Augsburg Diesel engines, which drive the propeller shafts thru reduction-gears

HOLLAND-AMERICA AND ROYAL MAIL LINES' MOTORSHIPS

On numerous occasions we have referred to the fleet of 14,000 tons, d. w. c. motorships building to the order of the Holland-America and Royal Mail Steam Packet Lines, and the names of some of their new vessels have been given. Other motorships nearing completion for these companies are the "Drechtdyk," "Lochmonar" and "Lochgoil."

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OPERATING COSTS OF THE "WILLIAM PENN"

USUALLY so careful when publishing data concerning motorships, "Nauticus" unfortunately published a very misleading discussion on the operating costs of the Shipping Board's motorship *William Penn* in its issue of May 20th. We will reproduce the editorial in question:

> "It is now stated that for 109 days at sea and 113 in port, the total fuel bill amounted to 10,980 barrels, costing $26,041, plus $1,894 for lubricating oil, or a total of $27,935. It is stated for purposes of comparison that an oil-burning steam-driven vessel of the same size and speed would have burnt 35,097 barrels of fuel oil, worth $80,318, and $1,117 of lubricating oil, making a total of $81,435, or a saving of $53,500 in favor of the motorship. This is all very fine, as far as it goes. The question is, How far does it go?"
>
> "In order to obtain an adequate comparison it is necessary to look into the figures. We find that the price of the oil consumed by the *William Penn* is given at $2.37 a barrel. An oil-burning steamer, however, uses ordinary fuel oil, which is worth about $1.27 per barrel in New York. On this basis, the oil consumed by a steamer of the same dimensions would amount to about $45,000, or $35,000 less than the figures given, thus reducing the difference in favor of the motorship to $18,500 in round figures. That is to say, in the course of two-thirds of a year, the motorship would show in active operation a fuel saving of $18,500. Taking now the greater cost of construction of the motorship, depreciation on cost, interest, reserve, insurance on excess value, and other incidentals, if a total of less than the calculated saving is arrived at, the motorship affords her owner an advantage over a steamer of the same dimensions and speed equivalent to the amount of such saving."

Reference to the article in MOTORSHIP for May, pages 345 to 350 will show that the price actually paid for the *Penn's* fuel was as follows:

860 tons at $2.01 per bbl.
300 tons at $1.68 per bbl.
193 tons at (about $1.83 per bbl.)
216 tons at $3.15 per bbl. (at Honolulu)
Total.....1,569 tons (not including fuel used on trials)

Of this quantity she burned but 1,475 tons, so she need not have taken all the high priced fuel at Honolulu. In any event the average price of the fuel was not over $2.00, whereas "Nauticus" says it was $2.37, compared with $1.27 for the steamers. Where did the Editor obtain these two prices?

The steamers with which the Board made their comparisons finished their voyages just before the *Penn* started her round-the-world trip and when the price of fuel was higher. So in order to avoid being unfair to the steamers the Board—when working out the steamer's fuel bill—took the costs of boiler-oils current when the *Penn* made her voyage. Had the Board published the actual fuel-bills of the steamers they would have been considerably higher, but would not have formed a genuine comparison, due to fluctuations of the oil market in the interim period. So to state that the steamers burned oil at $1.27 per barrel is ridiculous.

True it is that boiler-oil could be secured at a cost of $1.27 per barrel a few weeks ago. At that date Diesel-oil also was equally cheap, the fuel for the *Californian* for instance costing but $1.57. Hence. "Nauticus's" reasoning that the *Penn* only saved $18,500 on the voyage is totally inaccurate and misleading. Furthermore, "Nauticus" ignored the fact that the *Penn* started on her voyage fully loaded, and carrying nearly 1,000 tons more cargo than a steamer of similar dimensions and average speed could have taken, which meant additional cash to the operators. Why does "Nauticus" ignore this money-earning factor?

Altogether the *Penn* bunkered 1,609 tons of oil at a total cost of about $31,412, and on the maiden voyage of 28,567 nautical-miles used 1,475 tons at $26,650, the remainder of the fuel being left at the end of the voyage or used on her trials, together with her previously bunkered supply.

We reproduce herewith the comparison costs of the motorship *William Penn* and the steamers *Eclipse* and *Eastern Merchant* as given us by the Board; the figures for the *William Penn* being exact, while those for the two steamers being less than the actual cost, as they are based on the prices current at the time the "Penn" made her trip, as heretofore stated, and not at the higher prices current when they made their voyages.

As we have just said, it is very unfortunate that "Nauticus" should have published misleading figures that detract from the remarkable performance of the Diesel drive in the *William Penn*. "Nauticus" proceeds to ask where will the engineers come from if the 100 American steamers are converted to Diesel power. We answer,—from the same place as the engineers of the *Penn, Californian, Missourian, Cubore, H. T. Harper, Solitaire, Kennecott, Charlie Watson, Bayonne, Babinda, Brammel Point, Bacoi,* and a host of other U. S. Diesel-driven motorships.

William Penn (Motorship)	D.W.T. 12,375	Speed, 10.65 Knots	Fuel, 10,981 Bbl.	Cost. $26,041.92
Eclipse (Turbine-electric)	D.W.T. 11,733	Speed, 10.60 Knots	Fuel, 33,420 Bbl.	Cost. 75,192.50
Eastern Merchant (Steam Reciprocating)	D.W.T. 12,995	Speed, 11.00 Knots	Fuel, 35,697 Bbl.	Cost, 80,318.25

FROM ANOTHER CONTEMPORARY

IN its issue of May 20th the "Nautical Gazette" made the following statement—"There will be in the not far distant future an era of conversion of steamships to motorships, and within five years the motorship will be the prevailing mode, and steamships will be under a handicap. Therefore, the man buying a ship today naturally looks into the future and he realizes that to make his investment a profitable one he must have a motorship.

END OF THE WORLD'S GREATEST SHIPBUILDING PROGRAM

THE mammoth war programme of merchant ships of the United States called for 3,270 ships aggregating 18,407,276 tons deadweight, and of these 2,312 vessels totaling 13,636,711 were completed by 218 shipyards, the last being delivered on May 9, 1922. The first was turned over to the Shipping Board on May 24, 1917. Of this vast fleet, unequalled in the history of the world, only three were oil-engined motorships of which two were requisitioned small Lake-type craft. Is it any wonder that on May 21st of this year more than one thousand of these vessels were laid-up for want of cargoes, or because they badly needed repairs. Yet the Board's solitary ocean-going Diesel vessel is the most profitable and successful of these thousands of freight carriers. Comment is almost unnecessary, except to draw attention to the repeated warnings made by this magazine prior to and after the signing of the Armistice, when the Board's constructional programme should have been revised to include Diesel engine power.

U. S. WAR DEPARTMENT AND MOTORSHIPS

BY referring to other articles in this issue it will be realized that the U. S. War Department has done and is doing more to develop the economical Diesel-engined motorship than has the Shipping Board who, as intimated above, has only completed one such craft out of a total of 3,270 ships. Officials of the War Department are to be congratulated for having shown far more courage and foresight during the past few years than the Shipping Board, whose duty it was to give this country the most efficient type of vessel possible to secure. The fault does not rest with the present Commissioners, but with those who were responsible when the completion of our great merchant fleet was under revision following the Armistice.

PAY OF DIESEL ENGINEERS

NOTHING is ever gained by forcing the hand of a man or of a body of men. Consequently, the formulation of and putting into effect a new wage scale for motorship engineers by the M. E. B. A., 15% to 20% higher than the pay of steam engineers without consultation with shipowners is not to be condoned. It is only to be expected that under the circumstances shipowners would deny any official knowledge of the new scale. For several reasons MOTORSHIP has often recommended that the engineers of motorships be granted a special bonus, the same to be based upon reliable operation and the saving of fuel and lubricating oils. Given a good make of Diesel engine in a well-carried-out installation using so-called Diesel-oil as fuel, the work of the engineers is really easier and is carried-out under far more pleasant working conditions than that of engineers of a steamship, although a little more alertness and closer attention are necessary in the case of the motor job. But, when very heavy oils are used increased skill and additional attention are needed on the part of the engineers. Also. there is a tendency for a little more work, changing valves, etc. When these heavier oils are used the shipowner benefits by a saving in his fuel bill. In such cases he should give recognition to the engineers in the form of a bonus derived from this saving. If the case is presented in the proper light doubtless shipowners will be found not unreasonable.

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OIL-ENGINES IN LIGHT-SHIPS

Some Volund-Engined Craft

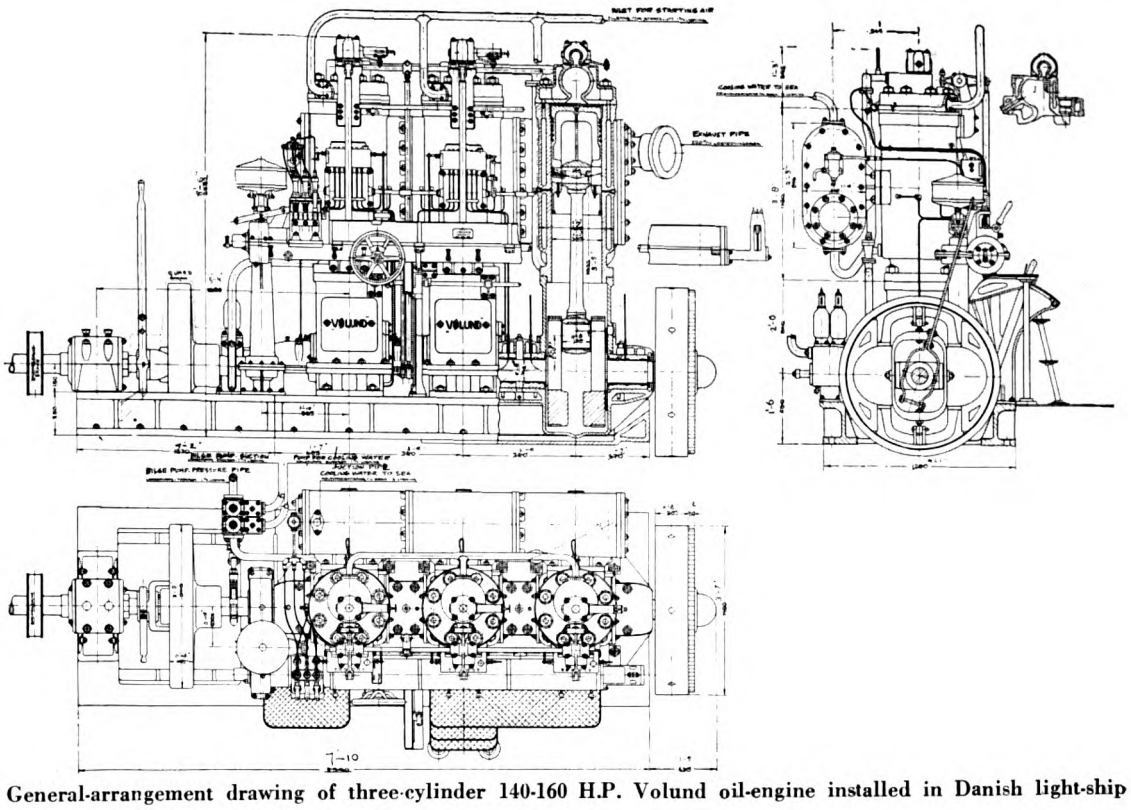
DANISH ocean-going motorships are well known among all maritime companies, but it is not so generally known that there is a large fleet of coastwise oil-engined craft or that the type of vessel upon which both depend for safety, namely, the light-ship, is being more generally equipped with oil-engines. For fourteen years small craft on the Danish coast have been fitted with the Volund two-cycle oil-engine, but only recently has this engine been installed in light-ships of that country. For this service it is evident that an engine must be absolutely reliable, since many lives depend upon it; under the very worst of conditions the light-ship's machinery must operate the best, so that such service should prove very interesting as well as demonstrating the value of the oil-engine.

Oil-engines have been installed in light-ships on our shores and there seems every reason for their use; fuel-expense and the attendant time required to bunker are both reduced, which means a saving to the government; therefore, to the people. Yet the latest American light-ships have been equipped with steam-engines, which must constantly keep up steam, whereas the motor-light-ship only runs the engines when lights or fog-horn or propelling-power are required.

In order to test the feasibility of oil-engines for light-ship service the Danish government installed an 80 H.P. Volund engine and found it so satisfactory that they have since equipped another light-ship with a 140-160 H.P. Volund oil-engine of the latest and most improved type. This installation was made in Light-Vessel No. 17, illustration of which we publish herewith, and has been put in service on a rough coast. Believing that our readers will be interested in learning more of this engine, we illustrate the same by drawings and briefly describe the principal features.

It will be noted from the illustration that this engine is of the two-cycle valveless type, having three cylinders and enclosed crankcase. These cylinders are of 13 in. bore and 17½ in. stroke and the engine develops its rated power on a consumption of fuel-oil of about 0.60 lb. per shaft H.P. hour. Starting is effected by means of compressed-air, the starting-valves in the cylinder-heads being actuated by cams on a horizontal shaft. A hot-bulb is heated either by torch or electricity. The operation of starting on air and shifting to oil-fuel is quickly and easily done by means of the maneuvering-lever. This lever also reverses the engine by being placed in the "stop" position, the hand-wheel shifts the cams to the reverse position and the lever is then moved to the starting position; after the engine is operating on air this lever is moved into full-speed position.

The fuel-pump is of the piston-type operated by the horizontal-shaft, this pump being controlled by the governor so that each cylinder gets exactly the proper amount of fuel at all speeds. Cylinders and water-jacket are cast integral and are of special steel, the piston is of the trunk type with four rings on the upper end, and one ring at the bottom to prevent loss of lubricating-oil, and the wrist-pin is of hardened steel, ground on the surface. The crankshaft-bearing is divided and lined with white-metal, lubrication being effected by an oil-passage drilled in the crank; crankshaft-arms are disc-formed and provided with counter-weights. No water-injection is used in this engine and the cylinder and combustion-chamber are water-cooled.



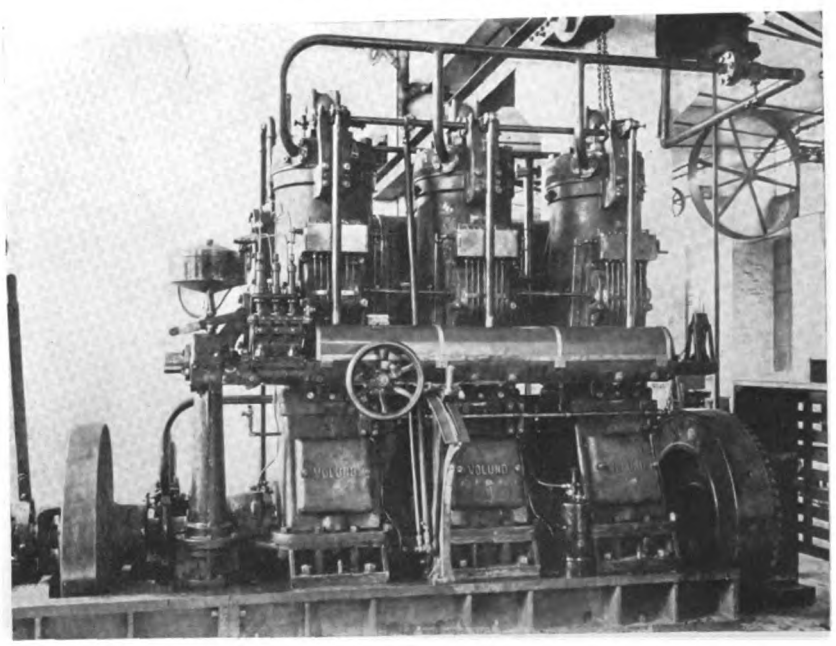
General-arrangement drawing of three-cylinder 140-160 H.P. Volund oil-engine installed in Danish light-ship

NEW YORK CITY ADOPTS DIESEL-ELECTRIC POWER FOR FERRIES

Progress is being made with the designs of seven motor ferry-boats to be built by the Department of Plant and Structures of the City of New York for service in the East River. Bids are to be received upon completion of these designs by the Department and it is estimated that the fleet will cost approximately $1,540,000. They will be of steel construction 175 ft. long, 64 ft. breadth and will be powered with two 400 h.p. Diesel-electric sets which will furnish power to drive these craft at a speed of 12 knots.

Commissioner Grover A. Whalen has taken keen personal interest in this forthcoming Diesel-electric fleet and Commissioner Whalen called to his office on June 5th representatives of Diesel-engine and electric-motor manufacturers, where he discussed with them for many hours various important features, based on a series of twenty-five questions which he had prepared, thus indicating the broadest sort of policy. No decision has yet been reached as to the particular make of Diesel-engine or electric-generators which will be installed.

The Danish light-ship "No. 17," in which a Volund oil-engine furnishes the power



The three-cylinder Volund engine of the Danish light-ship No. 17

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New American Marine Oil Engine

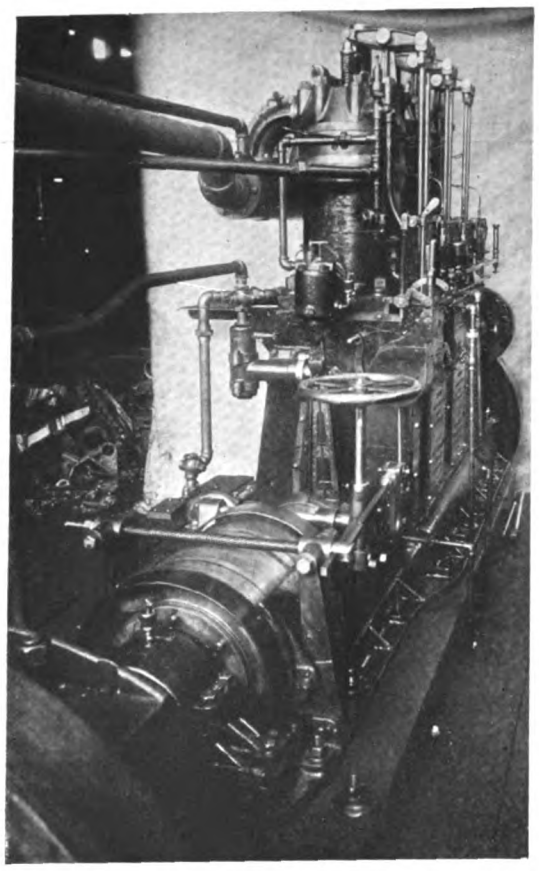
First Details of the Estep Airless-Injection Diesel-Engine for Small Motor-Vessels — Its Design Shows Unusual Accessibility

ON the Pacific Coast where conversions from gasoline, distillate and steam power are now being made almost daily in the tremendous fleet of workboats in the fishing, cannery and other commercial industries, it is not surprising that a number of engineering concerns are turning their attention to the development of oil-engines to particularly fit-in with local conditions, as well as being suitable for universal purposes in the field. Also several well established Diesel engine factories on the coast are exceedingly busy at the present time. The engines in demand range from 50 to 500 h.p. with the biggest output between 75 and 350 h.p.

This is the field hitherto generally covered by surface-ignition type two-cycle oil-engines, but at the present time on the Pacific Coast the greatest development is not with this design of engine, but with Diesel engines of the airless-injection type. Some manufacturers prefer to term this system direct-injection, others pump-injection, while a few prefer solid-injection. Some standardized term must, of course, eventually be found, but pending what we consider better nomenclature, MOTORSHIP will continue to refer to these engines as of the airless-injection Diesel class.

A new marine engine on this system has been running on the test stand continuously for the past three months at the Washington Iron Works, Seattle, constructed from designs and under the supervision of A. C. Estep, and in this issue of MOTORSHIP we are enabled to publish the first illustrated description. The initial engine, by the way, has been purchased by the American Tug Boat Company of Everett, and has been installed in their tug "R. P. Elmore," from which the steam machinery has been removed. We anticipate great economy of operation from the new plant, which will more than cover the cost of conversion in the first year.

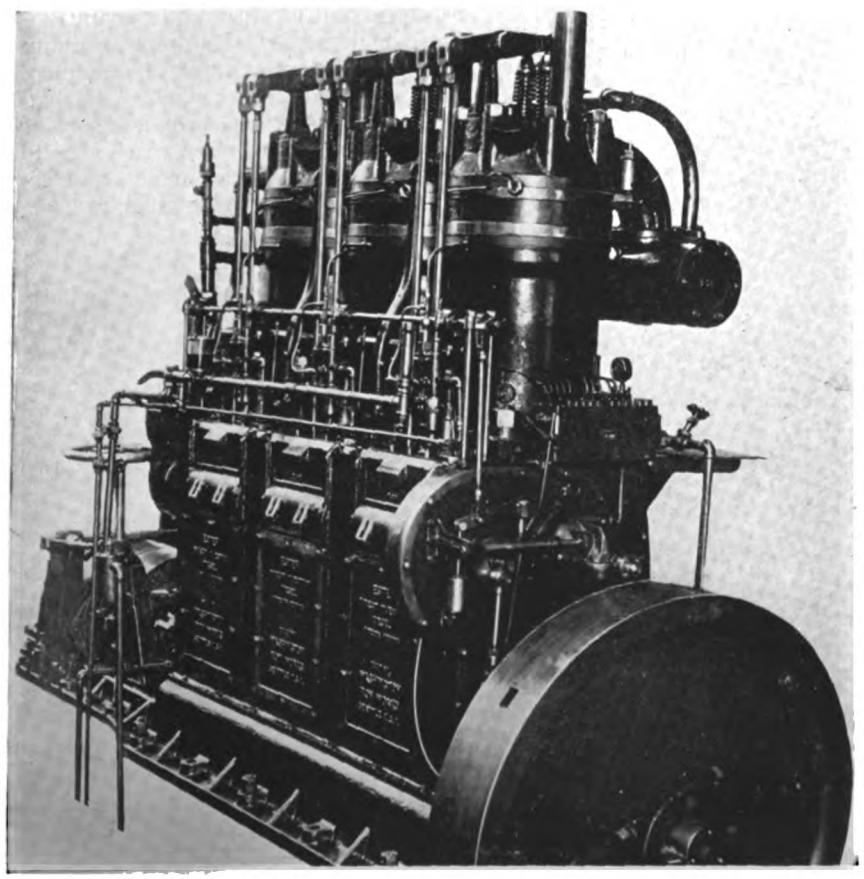
The Washington Iron Works is a company of substantial enterprise and for many years has been engaged in the manufacture of logging machines. It is significant to note that the company was one of the pioneer builders of marine steam-engines on the Pacific Coast but are now turning to internal-combustion power. Now under construction for them is a new plant of the most modern type. When the first engine has proven itself as successful in the boat as it has done on tests in the shop, the company will proceed with its manufacture on an important scale, particularly as they recognize there is quite a large market in the local field, as well as in other parts of the country and abroad.



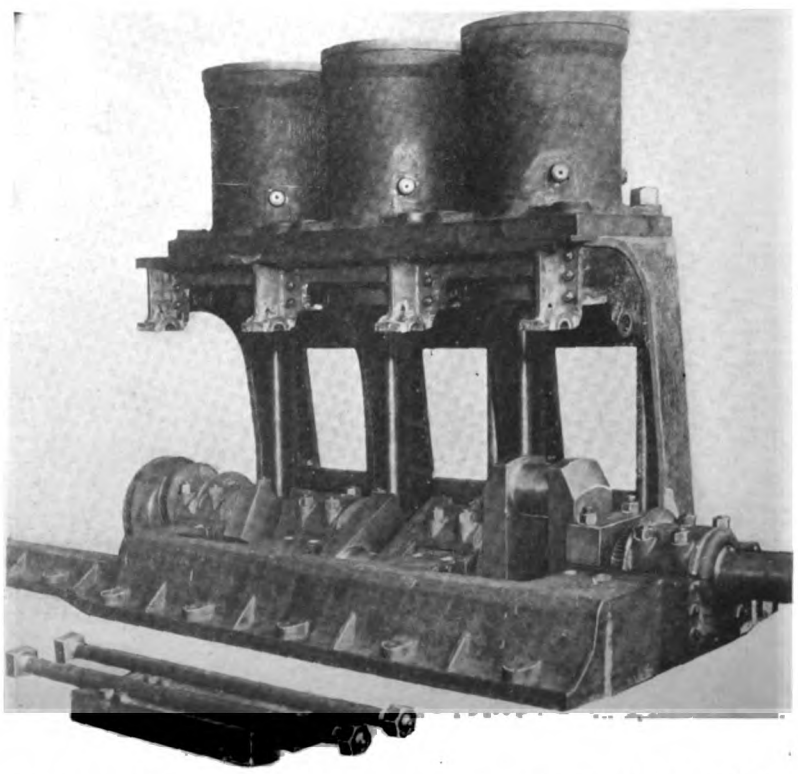
Installation of Washington-Estep engine in the tug "R. P. Elmore"

The sizes of engines to be manufactured will range from 65 to 140 b.h.p. In the engine illustrated there are three cylinders 10¾" bore by 16" stroke. It has a normal load of 100 b.h.p. at 280 r.p.m. when running with a continued M. E. P. of 85 lbs. per square inch. But it pulls 125 b.h.p. with ease and up to 140 b.h.p. as a maximum. Generally speaking, the Diesel four-stroke cycle has been followed, but a medium compression of 350 lbs. has been adopted, airless-injection engines usually having lower compression than those of the air-blast design. Starting is from cold, a simple water-cooled air-compressor being mounted at the after end of the engine for the purpose of charging starting-air tanks at 150 lbs. pressure. There are two fuel-injection valves of special design in each cylinder head, and an individual fuel-pump supplies each pair of injectors of every cylinder.

It is interesting to note that instead of the high pump pressure usually adopted with airless-injection engines, the designer has found it feasible to use a comparatively low pressure of 1,500 lbs. There is a governor control of fuel at all speeds. The cylinders are cast separately, each with its individual detachable liner, and are mounted on an entablature formed at the upper part of the frames that are bolted together, the cylinder liner extending through the entablature; the frames are mounted on a single bed-plate. It will be seen by referring to one of the illustrations that the engine-frame is detachable on the one side at the point of the camshaft bearings, allowing maximum accessibility and enabling the crankshaft to be moved out broadside on the front of the engine. The frame itself has large oblong orifices covered with easily removable plates. In these plates there are small inspection doors for observation purposes.



Washington-Estep 100 b.h.p. marine airless-injection oil-engine



Washington-Estep engine showing engine-frame and cylinder construction

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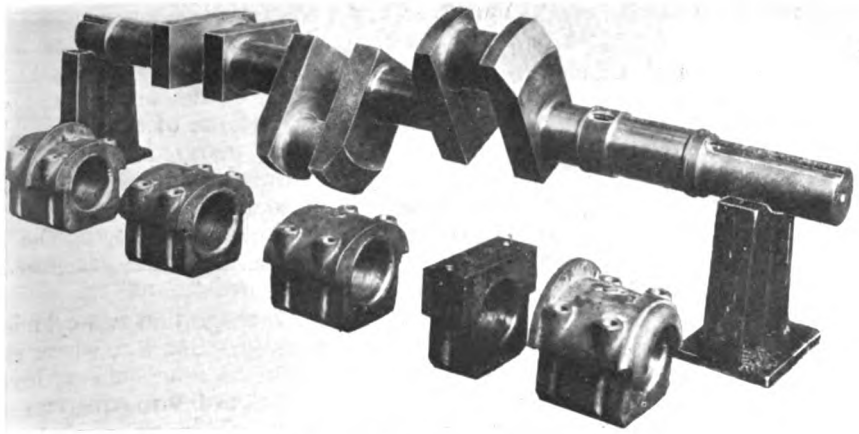
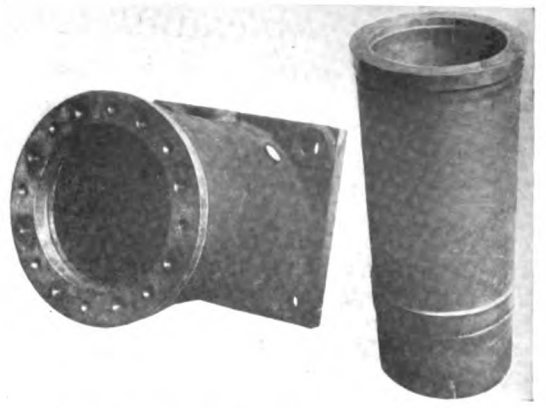


Crankshaft and bearings of the Washington-Estep engine



Estep design of cylinder and cylinder liner

Another illustration shows the removable bearings which are lined with nickle babbitt-metal, peaned and accurately machined to insure perfect alignment at all times. The crankshaft is 6¼" in diameter, is constructed according to Lloyd's specifications from an open-hearth steel forging. It is drilled for the force-feed oiling system.

None of the illustrations clearly show the design of cylinder head, although the exterior shape can be seen from the general view of the engine. We are advised it is of very simple design, cast of a special mixture and is provided with ample water-jacketing space. The inlet and exhaust valves are of a special hard iron with steel stems fitted to removable bushings in the head. For the camshaft drive the long vertical rod and overhead rocker system has been adopted, with the camshaft mounted about half way up the front side of the engine—all the cams being of hardened steel, are enclosed, and run in an oil bath, the drive being by spur gears with a bronze idle gear.

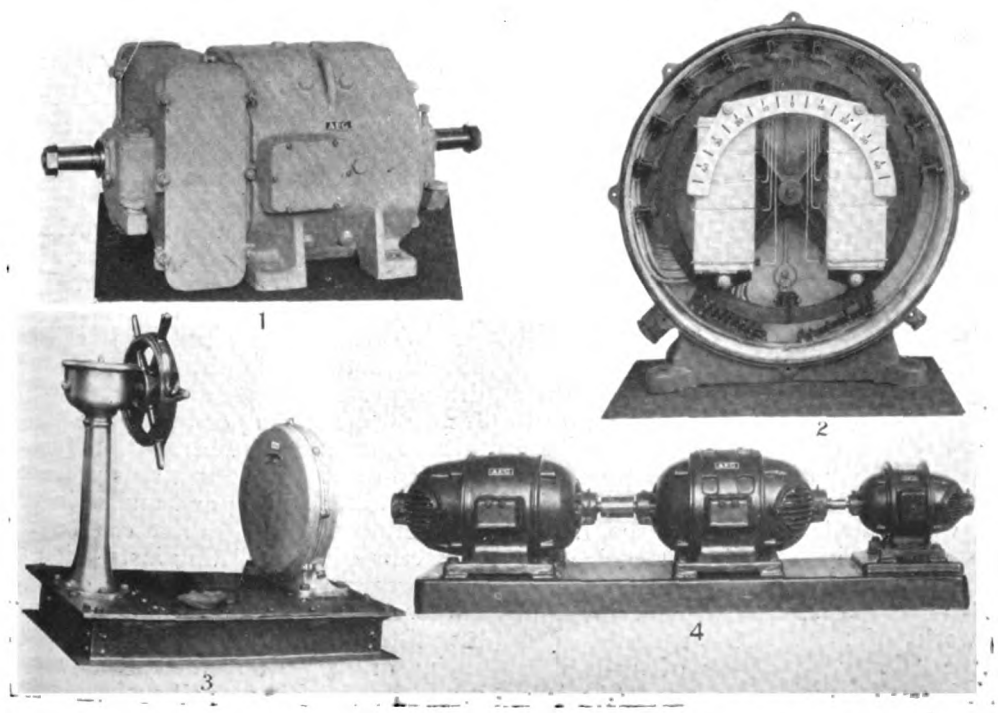
With an engine of this power the designers decided to adopt a mechanical reverse-gear and clutch, the latter being of the multiple-disc type. The thrust-bearing is of the removable type and is totally enclosed, water-cooled, and provided with a mechanical oiling system. For lubrication a force-feed system has been adopted, the supply being through a manifold and crankshafts to all bearings and crosshead pins. A sump pump collects the return oil from the crank pits through a strainer to an auxiliary filter and cooling tank. From the latter tank an automatic pressure-pump forces the oil to the bearings. In addition, a ten-feed Manzel mechanical oiler supplies clean oil for cylinder lubrication.

On tests it was found that the engine used 5½ gallons of fuel-oil per hour at a cost of 63 cents per gallon, in addition to 1/10 gallon of lubricating-oil at 40 cents per gallon. Thus the total cost of operation is 37 cents per hour, which compares with $2.02½ per hour for a distillate engine of the same power operating in the same district. This means an economy of over 80 percent.

NEW GERMAN ELECTRIC STEERING-GEAR

ONE of the most interesting items of equipment for motorships recently brought out in Germany is the A.E.G. electric steering-gear control, in the production of which this concern furnishes the electrical parts, while the mechanical parts are made at the Atlas Works, Bremen. Our illustration shows the component parts of this gear. A steering-wheel is mounted in a stand containing a rudder-adjuster which is set by the steering-wheel and has a contact-plate actuated by the steering-wheel. This contact-plate has four resistance-steps at each end and a number of fixed brushes connected by an equal number of leads to the fixed brushes of a rudder-controller, which has two insulated contact-plates having in one end four resistance steps. The contact-plates are connected with the differential-winding of an exciter feeding the field of a starting-magneto driven by the ship's electric-generating-set. The intensity and direction of the field of the starting-magneto, consequently the speed and direction of the steering-motor, vary according to which winding receives most current.

The Ward Leonard system is used, in which the armature of the starting-magneto of constant speed is clutched electrically to that of the electric-motor that drives the steering-gear. The rudder is driven by worm-gear and any position of the rudder-controller corresponds to that of the steering-wheel. The usual indicator on the steering-wheel stand shows the exact position of the rudder, which is thus set at any position by means of electric-transmission of the position of the steering-wheel to the rudder-controller through a multi-core cable. The whole outfit is rugged, yet susceptible of fine adjustment.



The A. E. G. Electric-steering Gear. (1) The Rudder-control motor; (2) rudder-controller; (3) steering-wheel and control; (4) the motor-generator

SOME FACTORS LIMITING THE POWER OF DIESEL-ENGINES

Paper Read Before the Institution of Engineers and Shipbuilders in Scotland, by A. D. Bruce

The possibility of Diesel-driven passenger-ships of high speed and dimensions comparable with those of the present steam-driven craft persistently appears in the minds of those concerned with this type of engine; that such engines are not now available is well known but the factors which at present limit the power are being studied, which will result in considerable progress, we believe.

In Mr. Bruce's paper the limitations of dimensions and weight and of thermal conditions at present affecting the production of high-power in Diesel-engines is fairly treated, the former by comparison with steam-installations and the latter limitations as affected by stresses produced by varying temperatures of the parts exposed to combustion. Mr. Bruce assumes that the four-cycle engine is most suitable because the two-cycle engine does not develop the extra power which would be expected for engines of similar cylinder size, yet states that as the cylinder diameter increases the engine will assume proportions such as to make it unsuitable for larger powers, say, 15,000 h.p. By comparison with a 15,000 h.p. quadruple-expansion steam-installation he claims that single-acting Diesel-engines are unsuitable because of weight and space requirements, while with regard to temperature stresses the two-cycle double-acting and the four-cycle single-acting engines are about equal the former is better than the single-acting two-cycle engine.

That the two-cycle double-acting or the opposed-piston engine are the only feasible engines for powering a 15,000 passenger-ship of 18 knots is the opinion of Mr. Bruce.

The high temperatures associated with Diesel-engines have prevented the construction of direct-drive engines suitable for high-speed passenger liners because they set up a flow of heat from the gas to the cooling-water, which sets up a difference in temperature between the inside and outside surfaces of the liners, covers and pistons. This question of heat-stresses and design of liners, ports and valves are also discussed.

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Splendid Record of the "Teco"

First Small Wooden Coastwise Motorship in British Columbia Has Logged Over 63,000 Miles with Remarkable Reliability

THERE is one field of shipping which should interest in greater numbers the builders of small oil-engines, shipbuilders and operating-firms; this is coastwise freight service which is more stable than many lines of shipping which depend to a great extent upon overseas trade conditions. In many sections of the coast there are established freight lines handling local shipments from port to port and there are many concerns operating small cargo-carriers in their business the year-round. Too many of these are steam-driven and being of the smaller type with more or less skilled labor in the engine-room they are particularly unsuited for the work because of the enormous waste they entail.

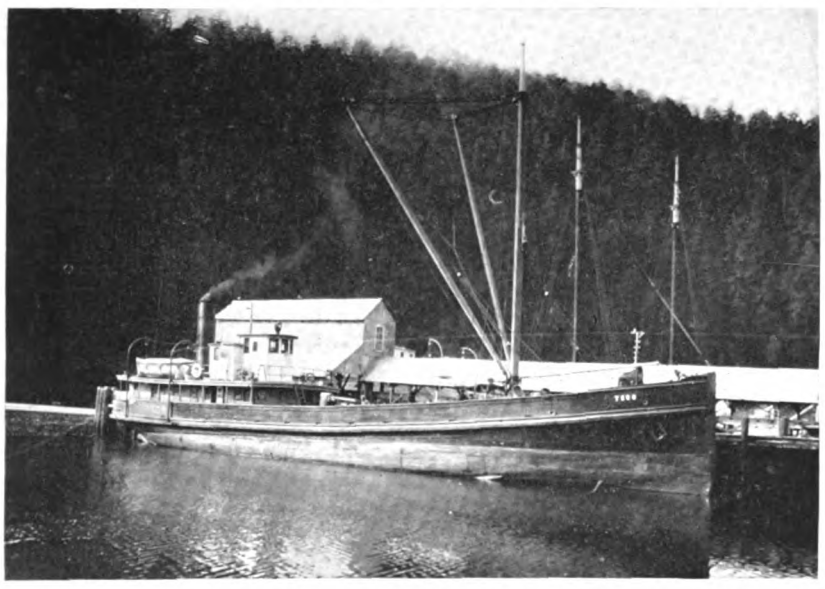
This field of cargo-carriers of 100 to 1,000 tons capacity requiring engines up to say 500 h.p. has been entered by the oil-engine, however, and the performances which have been made have been exceedingly satisfactory. So quietly and steadily do these motor-craft go about their business, coming into port, unloading, loading, slipping out again, that their good work is not so generally known. Therefore, we believe that the work of the wooden coastwise motorship "Teco" owned by the British Columbia Cement Co., Ltd., of Victoria, B. C., should be recorded in MOTORSHIP. She has the distinction of being the first vessel of her size in the British Columbian coastwise freight service to be driven by oil-engines and is of the following particulars:

Cargo-capacity	300 tons
Gross Tonnage	194 tons
Length	125 ft.
Breadth	24 ft.
Draft	11 ft. 6 in.
Horse-Power	160 H.P.
Type of Engine	Bolinders
Revolutions	225 R.P.M.
Speed of Boat, loaded	8 knots
Fuel capacity	10 tons
Fuel-consumption, daily	0.87 tons
Fuel-consumption, per hour	8.2 imp. gals.
Lubricating-oil, per hour	0.14 imp. gals.
Cruising-radius	2,000 miles

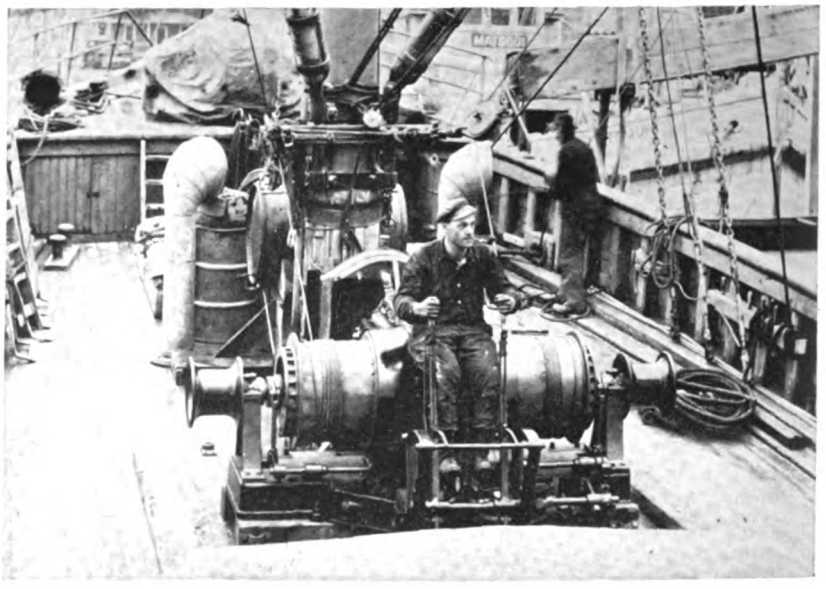
Since the "Teco" was completed in May, 1919, she has been operated regularly by her owners transporting cement generally between Vancouver and Stewart, B. C., a distance of approximately 600 miles. Up to the time our information was received this reliable little craft had logged 62,940 miles in 386 voyages without a single stop because of engine trouble except one-half hour delay because of a broken fuel-pipe. Chief Engineer James L. Detweiler, who has been chief since the "Teco" was built in 1919, states that he is satisfied that this type of engine has proven its reliability under all conditions.

Her two-cycle surface-ignition two-cylinder Bolinder oil-engine is installed aft, where are also found the crew's accommodations, leaving practically the forward three-quarters of the vessel for cargo. This engine turns a three-blade bronze propeller 68 in. diameter, 54 in. pitch, with an area of 11 sq. ft. at 225 r.p.m., giving the vessel an economical speed of 8 knots loaded with about 300 tons of cement. These sacks of cement are unloaded by a derrick-mast served by a Brooklyn silent winch which handles 1,200 sacks per hour, discharging the entire cargo in about six hours.

We fully believe that more vessels like the "Teco" should be operated on our coasts and feel confident that as the reliability and economy of the oil-engine is fully demonstrated and made public that considerable interest will be awakened.



The motorship "Teco," which has proved herself to be an excellent and economical vessel



Deck scene on the motorship "Teco," unloading cargo at a British Columbia port

LAUNCH OF BIG PASSENGER MOTOR-LINER "ADDA"

There will shortly be nearly half-a-dozen Diesel-driven passenger motor-liners carrying 300 or more passengers on ocean routes, including the *Domala* and the *Aba,* already in service.

The latest vessel of this type, namely the *Adda,* built by Harland & Wolff for the African service of the Elder-Dempster Line, has just been launched at Greenock, Scotland.

She has passenger accommodation for a total of 331 passengers, of which 225 are first-class, 74 second-class and 32 third-class. In addition to the passenger accommodation a considerable amount of cargo can be carried in six holds. She was laid down under the name of *Ancobra.*

For propulsion of the ship there are two 8-cylinder four-cycle type Harland & Wolff, B. & W. Diesel-engines each developing 6,200 I. H.P. at 115 R.P.M.

The general accommodation includes the dining-saloons, lounges, reading, writing and smoking rooms. Electric heating and cooking devices have been fitted in all the passenger and crews' accommodations. In fact, very complete electrical equipment is provided, current being provided by three main and one emergency dynamo, each of 100 K.W. at 220 volts. All four sets are driven by Diesel-engines. There are about 1,200 electric lights throughout the ship. In the engine-room, driving the auxiliaries, there are 20 electric motors. On deck there are twelve winches, steering-gear, windlass, warping winch and two large ventiating fans, all electrically driven.

STERN-SONNEBORN'S MOTOR TANKER "OSSAG"

REFERENCE has been made in previous issues to the new single-screw Diesel-tanker "Ossag" built to the order of the Oelwerke Stern-Sonneborn A/G of Hamburg, Germany, by the Deutsche Werft of the same city, in which a German built 1,500 I.H.P. Burmeister & Wain Type Diesel engine has been installed, this engine having been constructed under license at the turbine and Diesel works of the A.E.G. at Berlin. Recently the "Ossag," which is of 4,000 tons d.w.c. left on her maiden voyage. She is a sister ship to the first Deutsche Werft tanker. namely, the "Julius Schindler" owned by other German interests. She has a length of 324′ 8″ by 45′ 3″ and a depth of 23′ 11″, and is constructed to German Lloyd's highest class. Her speed is 9.7 knots loaded. The six-cylinder four-cycle propelling engine has a bore of 24.80″ by 37.79″ stroke.

There are six main tanks for the carrying of 4,000 metric tons of oil, while on either side four summer tanks are provided. The main holds are divided by means of a longitudinal center bulkhead. Loading and discharging is effected by two steam-driven duplex oil pumps and a full cargo can be taken aboard in twelve hours. Should water accidentally enter the cargo holds when taking ballast or while loading or through leakage, there is an arrangement whereby the fuel can be pumped-out from the top, thus preventing the oil and water mixing and mulsifying. When gas forms from the oil it can be removed by means of a ventilating installation and the high-pressure blower. For fire extinguishing purposes a steam-fire fighting apparatus has been fitted. In addition to an auxiliary Diesel engine driving the auxiliary compressor and generator, there is a small surface-ignition engine emergency set and an oil-fired donkey boiler for operating the cargo pumps, tank heating, winches and windlass.

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First Transmarine Corp. Diesel-Tug in Service

"Transco No. 2" Proves Successful on the New York Barge Canal

FOR many years uneconomical steam-tugs have handled towing on the Hudson River and the Barge Canals of New York while Diesel-engined tugs have been operated successfully in many sections. In the past year oil-engined tugs have made trips through the Canal, but the tow-boat fleets working there have continued to be steam-powered. Not only is the steam-tug at a disadvantage because of the frequent repairs necessary, but because the steam-boiler consumes so much coal that frequent coaling is necessary and the draft of the tug is increased to a figure greater than necessary in the case of an oil-engined tug. The loss of time and the inconvenience of stopping to take on more coal while passing through the Canal causes delay in delivery at the terminals which has been a big factor in causing the officials of the Transmarine Corporation to adopt Diesel-drive when they entered into such work. This company is one of the largest shippers via the Barge Canal and the Canal Division of the Transmarine Corp. had just had constructed three Nelseco Diesel-engined tugs to handle their big barges.

These tugs have created considerable comment among shippers on the Canal and the first to be completed has been demonstrated to officials of the New York State Department of Public Works and others with complete success. This tug is the "Transco No. 2," which was completed by the Hildebrant Dry Dock Co. at Port Ewan, adjoining Kingston, N. Y., on May 13th, and the official trial trip was run on May 14th. "Transco No. 2" is a wooden tug of excellent design by the builder's naval architect, R. R. Livingston of New York, 67 ft. 6 in. long, 17 ft. 6 in. breadth and 7 ft. 6 in. draft; the extreme height from the water to the top of the pilot-house is kept within the minimum required to enable her to pass under all the bridges on the Canal. Her construction is very substantial and designed for the hardest of service; her lines are attractive and she presents an appearance of being able to handle any towing job she tackled. That she can do this she has proved since her trials, which were witnessed by Messrs. MacClurkan and Muller of the Canal Division and Mr. E. P. Worden of the Submarine Boat Corp.

These trials were run on the river from Kingston to Albany where she arrived about 6:30 P. M. on May 14th, her average speed being 11.3 statute miles per hour at 334 r.p.m. on a consumption of 10½ gallons of fuel-oil and with a moderate lubricating-oil consumption. Throughout the trip the engine operated without trouble of any kind, there was practically no vibration, no smoke, and the boat handled promptly and well. Following a demonstration to the Barge Canal authorities on May 15th the "Transco No. 2" proceeded through the Canal with a tow of five barges; meeting an East-bound tow at Little Falls, tugs were changed and the "Transco No. 2" towed the barges to Pier 6, East River, New York, arriving about 6 P. M. on May 23rd.

She handled the string of barges better than steam-tugs had done and this work was done in the most difficult section of the Barge Canal, containing 17 of the total 35 locks and during a time when the water was running high because of Spring freshets, as well as in the crowded tidal waters of the lower Hudson River in New York harbor. It should further be noted that the fuel-tanks of 3500 gals. had been filled at Albany on May 16th and that upon arrival at Pier 6 they were about half-full. Contrasting this with the fact that the steam-tugs which do this towing must stop for coal about every 24 hours it will be readily noted that valuable time is saved to shippers where the Diesel-tugs are used. Time is also lost because of poor steaming when cleaning fires and when disposing of ashes.

Her four-cycle, eight-cylinder 9 in. by 12½ in. Nelseco Diesel-engine develops 240 h.p. at 350 r.p.m. at a cost of 60 cents per hour with a tow, this figure having been obtained from her operating-data. Steam-tugs of similar horsepower operating on the Canal cost $4.00 per hour for fuel. And they are not ready for service at one minute's notice to the engineer as is the "Transco No. 2." Her propeller is of 61 in. diameter and 36 in. pitch. As we go to press the "Transco No. 3," a sister-ship to the subject of our article and "Transco No. 1," a 60 ft. tug of similar breadth and draft, but powered with a 180 h.p. Nelseco engine and equipped with a Kitchen rudder, are also going into service.

ONE YEAR'S SERVICE OF THE DIESEL-ENGINED TUG "COLON"

ANOTHER instance of the extremely satisfactory service being given by small Diesel-engines in tow-boats has come to our attention in the record of the past year's work of the motor-tug "Colon," owned by the Oakland Launch & Tugboat Co., of Oakland, Cal. An illustration of this craft appeared on page 727 of the September, 1921, issue of MOTORSHIP, and she is 39 ft. 3 in. long, 11 ft. breadth and 4 ft. 9 in. depth.

In this sturdy little work-boat was installed somewhat over a year ago a three-cylinder four-cycle mechanical-injection Atlas-Imperial Diesel-engine of 55 H. P., the first engine of this type and size built by that company. Before being fitted in the boat this engine was run in the Atlas-Imperial factory for four months on the test-block and carefully adjusted in every way, which operation undoubtedly caused all the moving parts, especially the valves, to run particularly smooth and with perfect fit. With this long working-in of the valves as a foundation the engine has operated so well that, contrary to the opinion held by some engineers that it is advisable to grind valves about every 200 working hours, the owners state in a letter to MOTORSHIP that "no exhaust or inlet-valve has been touched and the boat has been in almost daily service."

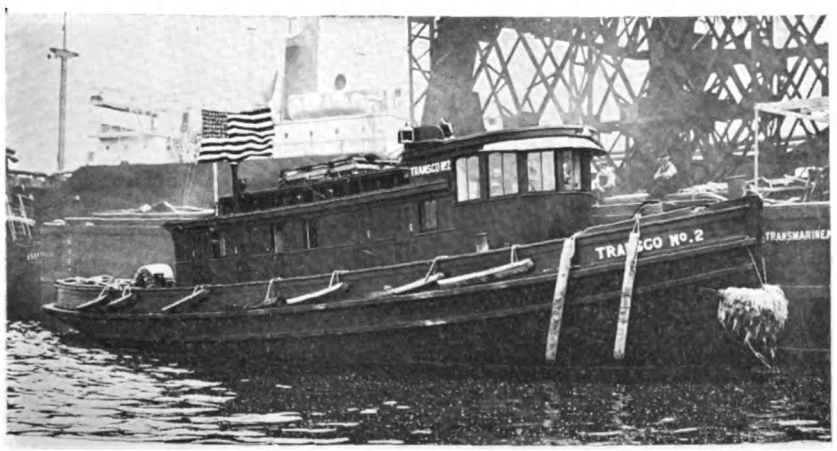
The fuel bills show a fuel-consumption of 2¾ gallons per hour on fuel that costs 5¼ cents per gallon. Lubricating-oil used averages one gallon in 22 to 25 hours' run. "This," say the owners, "is surely cheap power and we will gladly tell anyone interested in Diesel-engines that we have found ours a dependable engine that has given us satisfactory service."

REVIEWS

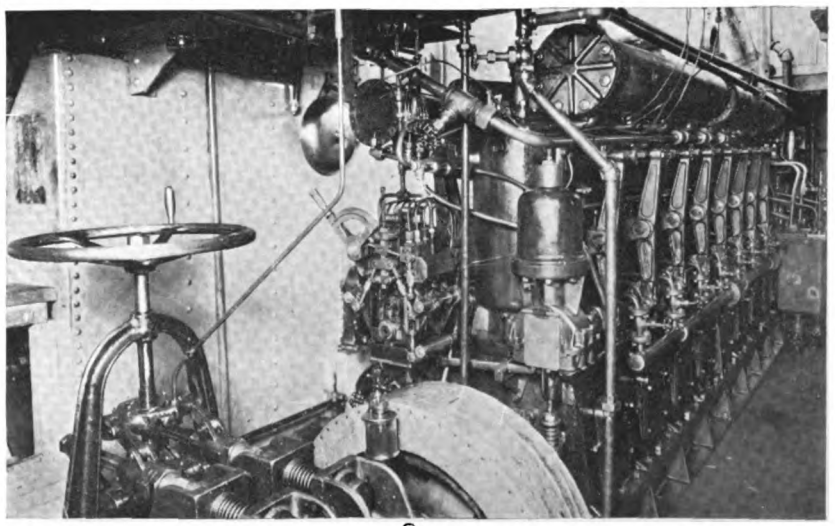
Electric Ship Propulsion. By Commander S. M. Robinson, U. S. N. Published by Simmons-Boardman Publishing Co. 1922. 274 pages. Electric-propulsion has perhaps reached a higher state of development in the United States than elsewhere and, as Chief Engineer of the U. S. Navy, Commander Robinson has had exceptional opportunity to become thoroughly acquainted with it. In this well-illustrated book every phrase of electric-propulsion is described both as to general system and detail. Commander Robinson divides all ships into five classes as regards electric-propulsion, stating that for "low speed cargo vessels of less than 3,000 horse power" the Diesel-electric propulsion is suitable. He states that while "the Diesel-engine in its present state of development is quite suitable that there are not more ships with Diesel-engines is probably due to the difficulty of starting this engine under load and reversing it" whereas in electric drive neither of these difficulties are met. Chapter XVI is devoted to Diesel-electric drive in which the author shows that with this system direct-current and series-operation should be used and an interesting comparison of 1400 h.p. Diesel-electric and triple-expansion steam-plants is given which indicates the great economy of the former.

WOODEN FLEET TRANSFERRED

It is reported that the Shipping Board's Lake Union fleet of 43 wooden ships have been transferred to the Barde Industrial Co. at a price of $1,800 per vessel.



"Transco No. 2," first of three Nelseco Diesel-tugs of the Transmarine Corp.



Engine-room of the Transmarine Corp.'s Nelseco Diesel-engined tug "Transco No. 2"

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GERMAN-BUILT TANKER FOR ITALY

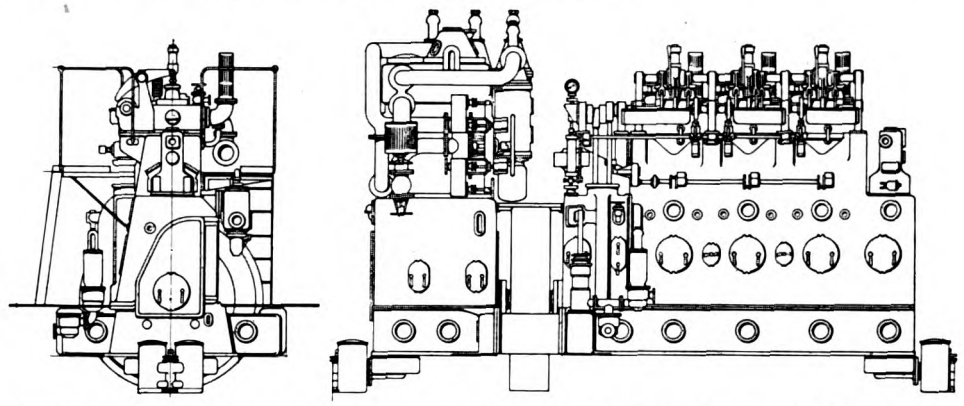
A Twin-Screw Diesel Ship of 2,000 Shaft H.P., Built and Engined at the Deutsche Werke, Kiel

BOTH the Deutsche Werke of Kiel, and the Deutsche Werft of Hamburg, have now constructed Diesel-driven tankers, but the Hamburg concern's vessels are single-screw, whereas the first tanker to be built at Kiel is a twin-screw job. There is no connection between these two shipyards.

In our issue of April we published a complete and illustrated story on the new Deutsche Werke 6-cylinder, 4-cycle 1,000 shaft h.p. Diesel engine. It is this engine, together with a duplicate, that is being installed in the 8,300 tons d.w. tanker now constructing for Italy, which vessel will be completed by November next. The first engine has already carried out complete workshop tests, while the second is now in final stage of erection. The dimensions of this tanker are as follows—

Displacement loaded	(about) 11,750 metric tons
Displacement light	(about) 3,450 metric tons
Normal cargo-capacity of holds, excluding fuel, water and stores	(about) 7,600 tons
Length, o. a.	413′ 10″
Length, b. p.	408′ 0″
Breadth (moulded)	53′ 11″
Depth (moulded)	30′ 4″
Mean Loaded Draught	31′ 0″
Fuel-capacity in double bottom	190 tons
Fuel-capacity in deep-tank	170 tons
Total amount of fresh water carried	50 tons
Cruising radius	44 days or 10,500 miles
Shaft H.P. of main engines	2,000 b.h.p.
Indicated H.P.	2,400
Engine speed	135 R.P.M.
Bore & Stroke	550 mm by 900 mm (21.65″ by 35.43″)
Propeller dia., pitch & area	10′6″, 8′10″, 9′1″
Daily fuel-consumption	(about) 9.2 tons
Stipulated Ship's speed (loaded)	10 miles
Weight of main engines with thrust-block, but without propeller & shafting	270 tons
Weight of complete engine-room machinery with propeller, shafting & auxiliaries	420 tons
Type of deck-machinery	air-driven auxiliaries
Length of machinery space	64′

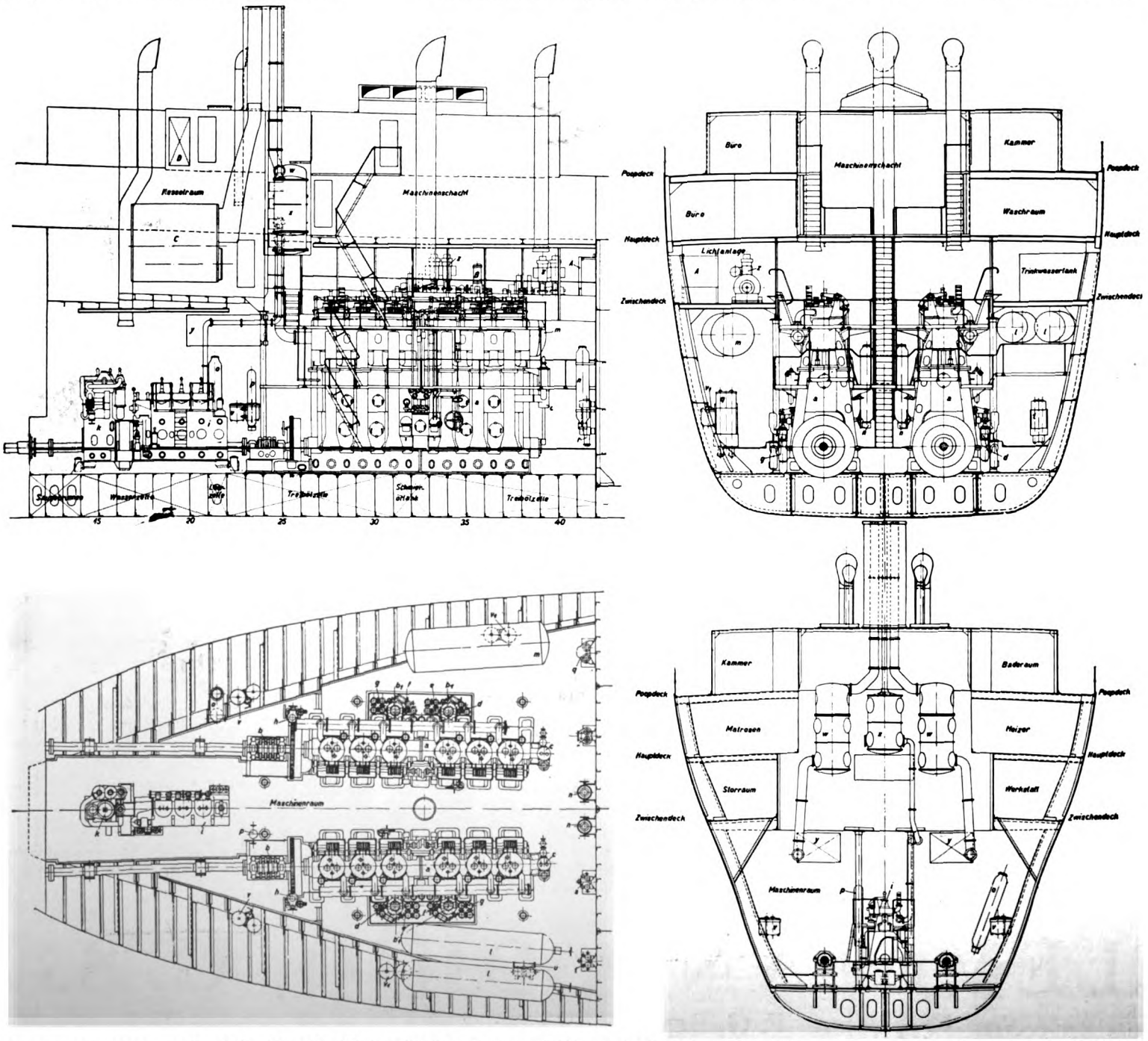
We note with considerable interest that practically all the auxiliary machinery will be driven by compressed air but are not satisfied that it will prove to be the best system.



Diesel-driven air-compressor for engine-room of Deutsche Werke tanker for an Italian owner

MORE ON THE MOTORSHIP "LASSEN"

In our March issue we published an article on the operation of the motorship "Lassen." The engines of this vessel are two 4-cylinder Skandia surface-ignition oil-engines of 420 mm. bore by 480 mm. stroke, developing 350 shaft h.p. at 250 R.P.M. There are also two Skandia auxiliary-engines one of 9 h.p. driving a generator, and one of 13 h.p. driving the auxiliary air-compressor. These engines were built by the Pacific Diesel Engine Co. of Oakland, Calif.



Engine-room arrangements of the Deutsche Werke (Kiel) twin-screw 8,300 tons deadweight tanker. This vessel should not be confused with the single-screw tanker "Ossag," built by the Deutsche Werft, Hamburg, and illustrated elsewhere in this issue

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Interesting Notes and News from Everywhere

The new motorship "Californian" of the American-Hawaiian Line made the trip from Boston, Mass., via N. Y. City, to San Francisco, Cal., in 31 days, almost fully loaded, averaging a speed of 12 knots on 14 tons of oil.

At the end of April, 1922, there were 712 motorships and commercial motor workboats aggregating 174,473 gross tons registered in Sweden.

"Johanna VII," an oil-engined river freighter built for the Kon. Paketvaart Mij, of Batavia, was recently launched by Huiskens & Van Dyk of Dordrecht, Holland.

On May 11th the first of the three Pacific-Werkspoor-G. E. C. Diesel-electric ferries for the Golden Gate Ferry Co. was launched at the James Robertson shipyard.

A 170 ton motor-yacht propelled by twin 180 shaft h.p. Kromhout surface-ignition oil-engines is being built by John I. Thornycroft & Co., for a British yachtsman.

Two 900 shaft h.p. McIntosh & Seymour crosshead-type marine Diesel engines have been purchased by the Munson Steamship Line of New York, from the U. S. Shipping Board Emergency Fleet Corporation.

An Egyptian firm has purchased the three wooden auxiliary motorships, "Geraldine Wolvin," "Jean Steedman" and "Jessie Norcross," owned by the Canada West Coast Navigation Co. Bolinder oil-engines are installed.

We understand that the new motorship, "Trinacria," built by the Eriksberg shipyard for the Swedish Lloyd, has been sold to other Swedish shipowners. This vessel has Gotaverken B. & W. Diesel engines.

A 167-ft. by 33 ft. Diesel-driven tug was recently launched at the shipyard of Franz Haniel & Co., Duisburg-Ruhrort, Germany, to the order of the Gutehoffnungshutte, of Walsum, for service on the Rhine.

Hugo Stinnes' new motor-tanker, "Oberschleissen," which was rebuilt from submarine and powered with submarine Diesel engines, was recently at Philadelphia where she loaded a cargo of oil for Ghent.

A new Diesel engine department equipped with facilities for producing high-powered Werkspoor four-cycle engines is now being erected at the yard of Hawthorn, Leslie & Co., of Newcastle-on-Tyne.

On the first 11,738 miles run of the North Eastern-Werkspoor Diesel-engine freighter "Sevilla," the fuel-consumption worked out at 50 miles per ton of fuel, carrying 2,000 tons of cargo. The power is 1,400 I.H.P. in a single-screw.

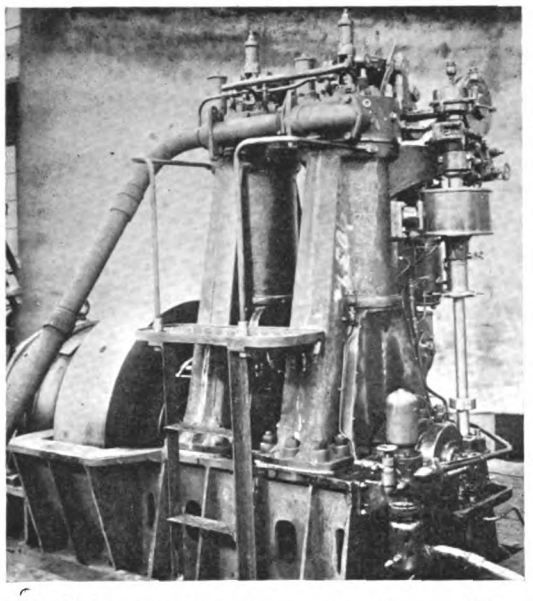
Revillon Freres Trading Co., of New York, have purchased a 400-ton auxiliary-schooner now building at Liverpool, Nova Scotia. A 100 b.h.p. Denzil oil-engine is installed. She will be used on the owner's Arctic supply service.

On May 31st, there was launched at the yard of Richard Diebold, Newcastle, Maine, the 140-ton fishing-schooner "Lark," built for O'Hara Brothers of Boston, Mass.

The N. V. Vrachtv Maats, Neerlandia, Amsterdam, Holland, has sold to P. Vellinga, of Delfzil, Holland, the "Helena," a 205-tons auxiliary vessel powered with two Kromhout oil-engines. She was built in 1917.

"Laanen aa," one of the 1,100-tons motor auxiliaries building for the Eesti Laeva Uhisus of Reval, at the Robert Lessner shipyard of the same city, was recently launched. She is propelled by a 225 b.h.p. Korting oil-engine.

Trials of the motor-tanker "Amstel," 160 tons d.w. were carried out on April 3rd. She is owned by the American Petroleum Co., Rotterdam, and is fitted with a 48 b.h.p. Deutz-Brons oil-engine. Her builders were J. Smit & Zoon, of Foxhol, Holland.



Atlas-Polar 60 b.h.p. four-cycle ships auxiliary generating set

The Norwegian motorship *Borgland* recently arrived at San Francisco with 3,050 tons of cargo in her holds. She is number 319 in the MOTORSHIP YEARBOOK for 1922. The *Fionia* (No. 72) and the *Bullaren* (No. 299) also recently called at that port.

Six German-built ex-submarine Diesel engines have been installed at the London Road, Thorpe Bay, and Southend-on-Sea, England, generating stations; two at each plant. Their combined output is 2,500 K.W. The total cost worked out at a very low figure.

On page 432 of our June issue we stated in error that the motorship *Californian* was equipped with a Hyde electro-hydraulic steerer. The electro-hydraulic steerers on the *Californian* were furnished by the American Engineering Company of Philadelphia, Pa.

The I. Ludwig Monwinckle Shipping Co. of Bergen has purchased the two Werkspoor Diesel-engined motorships, "Salerno" and "San Paulo," from Otto Thoresen and re-named them "Salta" and "Para," respectively. They will be operated between Norway and South America.

"De Wadden," a 251 tons auxiliary oil-engined vessel built by Gebr. van Diepen, Waterhuizen, Holland, in 1917, has been sold by the Nederlandsche Stoomv. Maats. Bestevaaer of Amsterdam, Holland, to Irish buyers. She is powered with two Standaard oil-engines.

Two airless-injection Diesel oil-engines have been ordered from the Worthington Company for installation as emergency wireless and lighting on the Shipping Board's liner "Leviathan." Each engine is a 3-cylinder 90 b.h.p. 2-cycle type and will be connected to a 60 K. W. generator.

Wm. Beardmore & Co. of Dalmuir, Scotland, have secured the contract for two of the 5,000 tons deadweight Diesel-driven motorships of the refrigerated-meat carrier type, and the Burntisland Shipbuilding Co. of Burntisland, Scotland, have secured the contract for the other two sister motorships. All four vessels are for the Western Australian Government.

On May 17th the 765 tons auxiliary wooden schooner "Ozmo" struck a rock off Cape Blanco on the Oregon coast and was severely damaged. Her radio calls were answered by the Coast Guard lifeboats, which saved the crew. The vessel was also saved. She is owned by the Northern Commercial Co. of San Francisco, and is powered with two 160 h.p. Bolinder oil-engines.

In our May issue we published a drawing of the Junkers type engine built by the Weser Company of Bremen. We have been advised by this firm that they no longer construct Diesel engines under Junkers patents, but are now building marine type Diesel engines under M. A. N. license.

Recently the Brocklebank motor liner "Malia" was put in the wet dock at Tranmere, Liverpool and her Cammellaird-Fullagar Diesel engines opened-up for examination, following her 16,000 nautical-miles voyage to India and return. We understand that everything was found to be in very good condition.

The course of fifteen lectures on Diesel engine practice that was given by C. A. Rosen of the Dow Diesel Engine and Pump Works of Alameda, California, as part of the university extension work of the University of California, will be given in San Francisco this summer under the auspices of the American Society of Marine Engineers.

The Compania Minera Choco-Pacifico of Andagoya, Republic of Colombia, South America, operate a Bucyrus dredge which is equipped with a 320 h.p. Bolinders stationary oil engine with centrifugal-governor direct-connected to a General Electric generator.

The directors of the Rotterdam-Lloyd are so satisfied with the performance of the cargo motorship "Kedoe" on a round trip to the Dutch East Indies, that they are now considering plans for a new passenger liner to be fitted with Diesel engines, which will be ordered as soon as conditions are suitable. This statement appears in the annual report of the Company.

Lloyd's Register of Shipping reports that there are at present 210 seagoing motorships, 178 being equipped with four-cycle and 32 with two-cycle Diesel-engines. One hundred and sixty-two vessels are twin-screw and forty-eight single-screw. Of the single-screw fleet 11 are between 1,000 and 2,000 gross tons, five between 2,000 and 3,000 gross tons and 12 are of 3,000 gross tons and over. The Register in the MOTORSHIP year book lists 791 motorships of 200 to 6,000 b.h.p. each.

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When the United Steamship Co., Ltd., of Copenhagen, recently offered $5,000,000 bonds through American Banks, publicity in this connection laid particular stress upon the fact that their fleet of 113 vessels included two large Diesel motorships.

Capt. Chris Christensen, of Noank, Conn., is removing the gasoline-engine from his work-boat "Alice" and installing a 15-20 H.P. Bolinder surface-ignition oil-engine in its place. The cost of this oil-engine will be saved in about nine months in saving of fuel-cost.

Two oil-engined shallow-draft stern-wheel river towboats are being designed by Cox & Stevens, of New York. One is for the Kelley Axe Manufacturing Co., Charleston, W. Va., and is to be 90 ft. long, 20 ft. breadth and 4 ft. depth, and will be powered with a 200 H.P. Fairbanks, Morse oil-engine. The other is a similar boat for the Peoria Grain and Barging Co., Springfield, Ill., and will be powered with a 60 H.P. oil-engine.

When recently inspecting the great White Star transatlantic liner "Majestic," the largest vessel in the world, we found on "E" Deck, way up high in the ship, an emergency Diesel-electrical generating-set of 70 K.W. The engine is a two-cylinder opposed-piston A.E.G. two-stroke Diesel-engine and power may be generated in an emergency not only for the wireless-telegraph and electric-lights throughout the ship, but also for the six 20 H.P. electric-motors for handling the Welin-davits which put the lifeboats overboard.

Regarding the article on the new German motorship "Rheinland" given elsewhere in this issue, the total weight of her long stroke slow-speed Diesel machinery, including auxiliaries, propeller and shafting, works out at 1,100 metric tons. This may be compared with a weight of 250 metric tons for the submarine Diesel engine and reduction-gear power plant of the sister motorship, "Havelland."

On May 15th the motorship "Erland" built by the Eriksberg yard for A. B. Tirfing of Göteborg, Sweden, was launched. She is built to Lloyd's highest class and is of the following dimensions: length between perpendiculars, 292 ft.; breadth moulded, 43 ft.; depth moulded to shelter-deck, 26 ft.; draft loaded, 19 ft. 6 in. She will carry about 3,500 tons when loaded to Lloyd's summer freeboard and will be driven by a 1,600 h.p. Diesel of Burmeister & Wain design.

An installation of a four-cylinder 90 h.p. Atlas-Imperial Diesel engine has been completed in the trawler "International No. 3" owned by the International Fish Co., of San Francisco, replacing a distillate-engine of 85 h.p. which was removed. The propeller of 48 in. diameter and 44 in. pitch was not changed, but the new engine turns this wheel 322 r.p.m. as against 275 r.p.m. formerly, driving the boat 11⅛ knots, whereas the distillate-engine drove her 8½ knots.

We should not forget that more damage can be done to boilers than to Diesel engines if inferior fuel-oil is taken aboard in the bunkers. For instance, some time ago a steamer bunkered oil which contained up to 40% of water, with the result that the damage done to the boilers was considerable. Had the vessel been propelled by Diesel engines, no harm to the machinery would have resulted.

The two 2,000 tons gross motorship "Dwarka" and "Dumra" of the British India Steam Navigation Co. are now nearing completion at the yard of Charles Hill & Sons, & Sons, Ltd., Bristol, England. Twin four-cycle type North British trunk-piston reversing Diesel engines of 500 shaft h.p. are being fitted in both ships. Each engine has six cylinders 15" bore by 30" stroke and turns at 175 r.p.m. Two 100 b.h.p. N. B. Diesel electric generating sets will furnish power for the auxiliaries.

On Monday, May 29th, the motor ferry "Poughkeepsie," built on the Arconstruct-Hullfin principle from designs by C. V. S. Wyckoff, was launched at the yard of the Atlantic, Gulf & Pacific Co., Mill Basin, Brooklyn, N. Y. Considerable interest was shown by the large gathering present in this new form of hull as well as in the Winton-Westinghouse Diesel-electric-sets then partially installed. Trial-trips will shortly be run of this first ferry-boat of this type.

A new heavy oil-engine of light weight construction, known as the "Rotoelmotor" has been produced by Deigmuller & Griesemann, Frankfurt a/Main, in both two and four cycle types. Fuel is injected into the cylinders by air-pressure through a double fuel-injection valve, this mechanism consisting of an inlet for the fuel and air, and a tube surrounding the fuel-spray, which can be closed or opened by a hand lever for the purpose of air starting, at the same time cutting-off the admission of fuel.

Two Diesel-driven motorships of 9,000 h.p. each will be built by the Oceanic Steamship Co. of San Francisco, Cal., if, under the new Merchant Marine Act, the U. S. Government grants the company an annual subsidy of $384,000 for mail carrying. Fred S. Samuels of the Spreckels Steamship interests recently stated he is assured that Diesel drive is the coming power, but that it must be known what effect the new Act will have and what is the future of the Australian trade before the Company ventures on an investment of $5,000,000.

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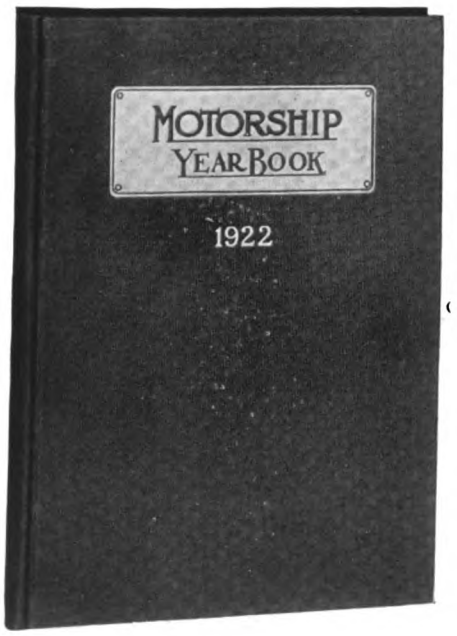

LEADING CONTENTS

Review of American Motorship and Oil-Engine Construction During 1921 (New Feature).
Questions and Answers on Operation of Marine Oil-Engines (Completely Revised).
The Most Complete Treatise on Tar-Oil Fuel Ever Published (New Feature).
List of Nearly 800 Motorships of over 200 b.h.p. now in Service, With Dimensions of both Oil-Engine and Hulls, and Names of Owners, Builders, etc. (Revised and Brought Up-to-Date).
List of Marine Oil-Engine Builders of the World (Thoroughly Revised).
Exhaust Piping and Mufflers for Commercial Motor-Craft (New Feature).
New A. B. S. Rules for Diesel Crankshaft Construction (New Feature).
American Bureau Rules for Diesel-Engine Construction (New Feature).
Lloyds Register Rules for Diesel-Engine Construction.
Conversion Equivalents of Heavy and Light Fuel-Oils (New Feature).
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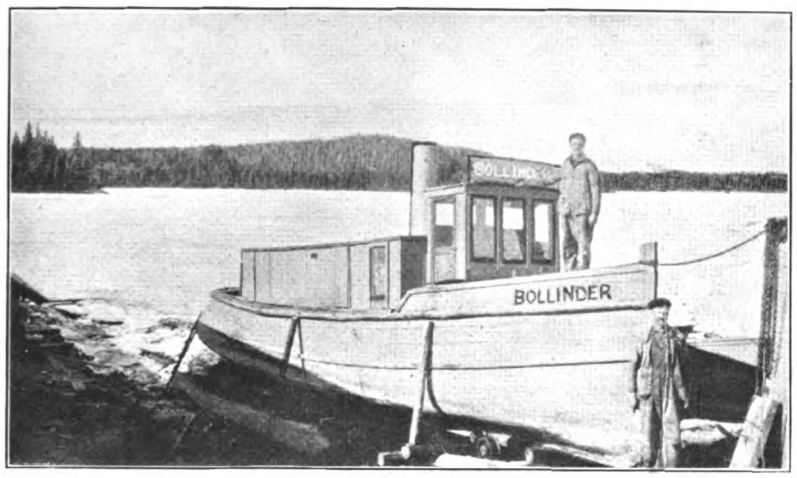
A surface-ignition marine oil-engine is being built under Venn Severin license by the Standard Gas Engine Co. of Oakland, Cal.

In our article "Oil-Coolers for Diesel-engines," on page 450 of the June issue, the last sentence should read "with minimum pressure-drop" instead of "maximum."

A 1,450-ton d.w. cargo motorship was launched at the end of May at the shipyard of Rennie, Ritchie & Co. of Wivenhoe, England. Twin 320 b.h.p. Bolinder oil-engines are installed.

Work has commenced at the Wm. Cramps shipyard, Philadelphia, on the construction of the six-cylinder 29⅛ in. by 59 in. slow-speed 2,300 I.H.P. Burmeister & Wain type Diesel-engine for the Hog Island class 8,000-ton steamer *Seekonk*, which recently was towed to Philadelphia from Charleston, S. C., for the conversion.



Fishing-Boat "Bollinder" Which Is Powered With a 20 H.P. Bolinder Engine

An illustration on this page shows the "Bollinder" in which a 20 H.P. two-cylinder direct-reversible Bolinder oil-engine is installed. She is a lake fishing-boat owned by Sand & Johnson at Cochrane, Ontario, Canada, way up North in Hudson Bay Country. The "Bollinder" is 50 ft. by 9 ft. by 2 ft. with 10 Knots speed.

In recommending a total subsidy of 9,150,000 Kronen for the new financial year of the Norwegian Merchant Marine, the Communications Committee of the Norwegian Storting pointed out that for local traffic the cost of operating the motorships was considerably cheaper than that of steamers, the former involving an outlay of 34 kroner per mile compared with 55 kroner per mile for the latter.

It was recently reported in MOTORSHIP that the McIntosh & Seymour engined motorships "Astmahco III" and "Astmahco IV" had been sold to Charlton B. Hibbard. Their names have been changed to "Glendarael" and "Ormidale" and they are being operated by C. D. Mallory & Co. in the coastwise trade. This company has chartered the 1,750 tons motor tanker "Pinthis" from the Marimon Oil Co. of Havana, Cuba, and will operate her in the U. S. Coastwise trade. This tanker is propelled by a 500 h.p. Bolinder surface-ignition oil-engine.

During the year 1921 the Deutsche Werft, whose yards are near Hamburg, Germany, made a gross profit of 14,600,000 marks, compared with 9,300,000 marks the previous year. The net earnings for 1921 amounted to 3,385,000 marks. Unlike most other German yards the stock capital of 20,000,000 marks was not increased last year, although extensions to the plant were made. During 1921 two 4,000-ton motor tankers were launched from the Deutsche Werft, as well as ten steamers and two floating docks. The company is now building motorships aggregating 65,400 tons and 24,000 i.h.p. At the Annual Meeting the directors declared that reciprocating steam-engines could no longer compete with Diesels and turbines, with regard to weight and fuel economy.

Four Diesel engines for two submarines for the Spanish Navy are now being constructed from designs of the New London Ship & Engine Company, Groton, Conn., by the Constructora Naval, of Bilbao, Ferrol, Cadiz and Cartagena, Spain, who are the Spanish representatives for Westinghouse electrical equipment, and which is affiliated with Vickers of England. It is possible that this Spanish firm may shortly construct Diesel engines under Augsburg license, the New London Company holding the American rights for the Augsburg engine.

Among the recent lectures of interest to the motorship world given before the American Society of Marine Engineers in San Francisco were the following "Diesel Engine Practice" (two lectures) by C. G. Cox, district manager, McIntosh and Seymour Corporation; "Diesel Engines" (two lectures), by A. A. Tacchella, San Francisco representative Busch Sulzer Bros. Diesel Engine Company; "Diesel Engines" (two lectures) by H. F. Gelhaus, port engineer, Swayne and Hoyt, Inc.; "Electric Propulsion" (two lectures), by M. Rhine, sales department, General Electric Company; "Application of Electricity to Deck Equipment and Steering Gear," by George E. Swett, district manager, Allan Cunningham Co., Inc.

A 1,000 shaft h.p. twin-screw passenger motorship 211′ length has been ordered by the Netherland Railways from Pot Bros., of Bolnes, Holland. Twin 500 b.h.p. oil-engines will be installed as well as two 14 h.p. auxiliary engines.

REVIEW

Kahlenberg Marine Engines. Bulletin issued by Kahlenberg Bros. Co., Two Rivers, Wis. We have read with interest this bulletin describing this well-known crude-oil engine, many installations of which have been referred to in the pages of MOTORSHIP. Of the surface-ignition type, it is built in two, three and four-cylinder models, each cylinder being separate. Operation is on the two-stroke cycle, compressing the air in the base, under the piston, on the down or firing-stroke, by-passing this air at the bottom of the stroke to the cylinder, scavenging the combustion chamber; on the up-stroke the air is compressed, and at the proper time, under the control of the governor, fuel is injected without the use of compressed-air. There is no electrical equipment. The engine is started by turning on air and fuel-oil, lighting the torch which heats the starting-tube, injecting fuel-oil by means of the hand-pump and then starting fuel-injection. No pre-heating is required; the fumes from the torches do not enter the engine-room, but are led to the outside of the cabin through a steel manifold.

Reversing is accomplished in three ways, *i. e.*, by air, by reverse gear, or by throttle-control. Two levers at the forward-end of the engine are provided—the air-injection and throttle-control levers and reversing by any of these means is a sure and simple operation. The reverse-gear is exceptionally heavy-duty and gives a speed on reverse of 90 per cent of the go-ahead speed. An efficient governor driven by gears running in oil can be set to permit any speed from 90 to 400 r.p.m. and this governor holds the engine to the desired r.p.m. by controlling the length of the stroke of the fuel-pumps. A four-cylinder engine has four power-impulses per revolution and when running at 350 r.p.m., which is average speed for Kahlenberg oil-engines, each occurs about one-quarter of a second apart; when the r.p.m. are suddenly increased the governor in about this short period of time has to lengthen the stroke of the fuel-pump of the next cylinder to function, this affording an idea of the quick-control of this governor which regulates the fuel-pumps for four cylinders, giving them exactly the amount of fuel needed to function at a certain r.p.m., all within the time the flywheel makes one revolution.

We believe that the fuel-oil handling deserves mention. The oil flows to the pumps from a service-tank which is fitted with a double-strainer having two and one-half square feet surface; before reaching the pumps the fuel is again strained and in each fuel-line just below the nozzle there is another strainer, this one passing the fuel through holes smaller than the injection-nozzle orifices, thereby preventing clogging. For lubrication there are two force-feed oilers, the port oiler taking care of all crank-shaft bearings and the thrust-bearings, this oiler using low-test oils. The cylinders, wrist-pin, crank-pin, etc. are taken care of by the starboard oiler, using high-test oil. When the engine is properly lubricated the exhaust is smoke-less and the engine is claimed to run smooth and without odor on a guaranteed fuel-consumption of 0.55 lbs. per brake h.p. hour. The fuel used is crude-oil above 24° Baumé and distillate, kerosene, etc.

One of the features mentioned by the Kahlenberg Bros. Co. which is valuable in an oil-engine is maximum accessibility to all parts. In their engine the main shaft bearings are not enclosed in the crank-case, but are immediately accessible between the cylinders and are also cooled by sea-water direct from the circulating-pump. The bearings are bronze shells with white-metal lining. An idea of the character of these bearings is gained by knowing that No. 1 bearing of a four-cylinder 100 h.p. engine weighs 17 lbs. and the crank-shaft bearings of this engine total over four and one-half square feet.

Such surface-ignition oil-engines are finding favor with operators of the great fleet of commercial motor-boats on our coasts and in our harbors. We believe that such engines will eventually drive the gasoline-engine from this fleet; our readers should therefore be interested in studying this and other engines of this type.

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Our Readers' Opinions

(The publication of letters does not necessarily imply Editorial endorsement of opinions expressed.)

DIESEL ENGINE EXHAUST TEMPERATURES

To the Editor of MOTORSHIP:

In the February and April numbers of your valued journal, you published letters and diagrams *from sources of high standing* on the subject of Diesel engine exhaust temperatures. At the risk of calling still more attention to the subject, I write to point out the danger of misleading the average engineer—to say nothing of the non-technical reader—who is not a specialist in Diesel engines, which writers of such specious arguments incur.

Have any of them really gone into the question of exhaust temperatures? Have they ever succeeded in measuring them, before glibly quoting figures? I believe not. They have no doubt measured something, but not the true temperature of the gases at point of release from the engine, and it should be remembered that this is the only temperature having a bearing on the efficiency of the cycle. After 10 years of research work carried out by the company and its predecessors, with which I am connected, and to whom this particular point is of special interest, we have to admit the impossibility of directly measuring this temperature: there is no piece of thermometric apparatus we know of that will read this intermittent fluctuating temperature.

In the case of the two-cycle engine, the measuring apparatus is subject to a hot blast of exhaust gas (already reduced in temperature by the cooling effect of the exhaust passages, unless the thermometer is held practically in line with the inner wall of the cylinder liner—generally impossible) and then to relatively cold blast of scavenge air, and will register some temperature between the two: whether the reading is a true mean, or some temperature above or below the true mean, it is difficult to even guess: but in any case is probably one or two hundred degrees low.

In the case of the four-cycle engine, the error is not so big, but due to the intermittent blast and the cooling effect of water cooled passages, the instrument reading is again an unknown amount below the real temperature. The only way to get even a fair estimate, is to calculate the temperature at release from the indicator card, and this is based on the accuracy of certain assumptions of a minor (sic) nature, such as the temperature of the air at beginning of compression and the specific heats of the gases.

To show the absurdity of comparing efficiencies on exhaust temperatures, I may add that one of the Still Engines exhausts at about 54° C. (130° F.) and this has been accurately measured, as the gas flow is steady: *but* it has first been through the steam-raising regenerator and a feed water heater!! Much depends on the passages through which the gases have passed before the temperature is measured or rather guessed with the help of a thermometer, and no two different types of engines can be fairly compared on this basis. As a fact, the above quoted Still engine (two-cycle) releases at an unusually high temperature,—so far as can be calculated by working backwards from the final temperature, through weight of gas and specific heats, and checking by the Indicator Card,—and yet, owing to the reduced loss of heat to the hot walls, has actually a higher combustion cycle efficiency than the normal two-cycle Diesel.

Between different engines such a comparison is useless and misleading, yet between different cylinders of the same engine it is frequently used for showing up any defaulter.

H. A. D. ACLAND.

The Still Engine Co., Ltd., London, S. W.

FROM ONE ENGINEER TO ANOTHER

To the Editor of MOTORSHIP:

I read with interest in your January issue the article by Mr. Hugo Moren of his experiences in a motorship, but as a marine engineer I will have to pull him up on one or two points, the first of which is regarding the fact that he felt something was wrong with the engines and was alarmed to find them turning only 80 r.p.m. instead of 102. Surely anyone with average hearing can tell the difference in the beat of an engine. One chief that I know used to be out of his bunk and down below for a mere difference of 10 r.p.m. Also even with the ship being aground, the engines should show their normal revs. or even slightly more.

Secondly, my experience of pistons, and exhaust or inlet valves is that one can hear on deck, also that the grooving of the cam was due to the pushrod and roller always bearing lightly on it, whereas even in the smallest of engines a clearance is given. But, in any case a cam that can be grooved so quickly must be very soft and consequently of no use.

I think Mr. Moren may think himself lucky that he has a whole skin left after several gray-iron extension pieces had smashed themselves up. Surely four screws is inadequate to secure such a thing to a piston of a high-speed engine.

Again, there must have been something sadly wrong with a refrigerating-set which requires a man to attend to it alone. The one we have aboard here is started at 7 A. M. every day and is then forgotten until such time as the engineer on watch looks at the temperature and when it is low enough the machine is stopped. Usually in English waters 4 hrs. per day is sufficient and down the Gulf runs 7 to 8 hrs. is plenty. Mr. Moren says that he will be interested to know how two-cycle engines operate on long runs.

Well, four-cycle airless-injection engines are fine, with no exhaust-valve trouble. In this ship's first year's run, no valves, either exhaust or inlet, were lifted and in the second year only one, but this was proved to be due to the fact that the valve-head water system was leaking and so the whole valve was working in oil and water which gradually percolated through to the seat which was made of gray cast iron. I hope that I haven't committed myself too strongly for publication.

WM. A. COWSILL.

M.S. "Narragansett," Schiedam, Holland,
March 30, 1922.

AIR PRESSURE FOR VISCOUS OILS

To the Editor of MOTORSHIP:

I have read with greatest interest Mr. Chaloner's article in your March issue. Regarding the handling of the most viscous grade of oil there is a great difficulty on board existing ships with their simple pumps.

But to take an example from the Swedish motorcycle Husqvarna, a simple means exists by which a thick lubricating-oil can be handled in a very cold weather and through small pipes. The lubricating-oil tank of this motorcycle is furnished with a hand air-pump by which an air pressure of 20 up to 60 lbs. can be applied on the oil and forcing it through the pipes at temperatures down to O°F.

If such an air-pressure can be applied on the fuel tanks in a motorship it should have a positive means to force oil up to the daily settling-tanks and a pressure on these tanks should supply thick oil to the fuel pumps on the engines without difficulty. The consumption of air would be very small and the tanks could be emptied to the last pints.

Every issue of your interesting paper acts very stimulatingly on me.

HUGO MOREN.

Civil-Engineer, Stockholm, Sweden,
April 1, 1922.

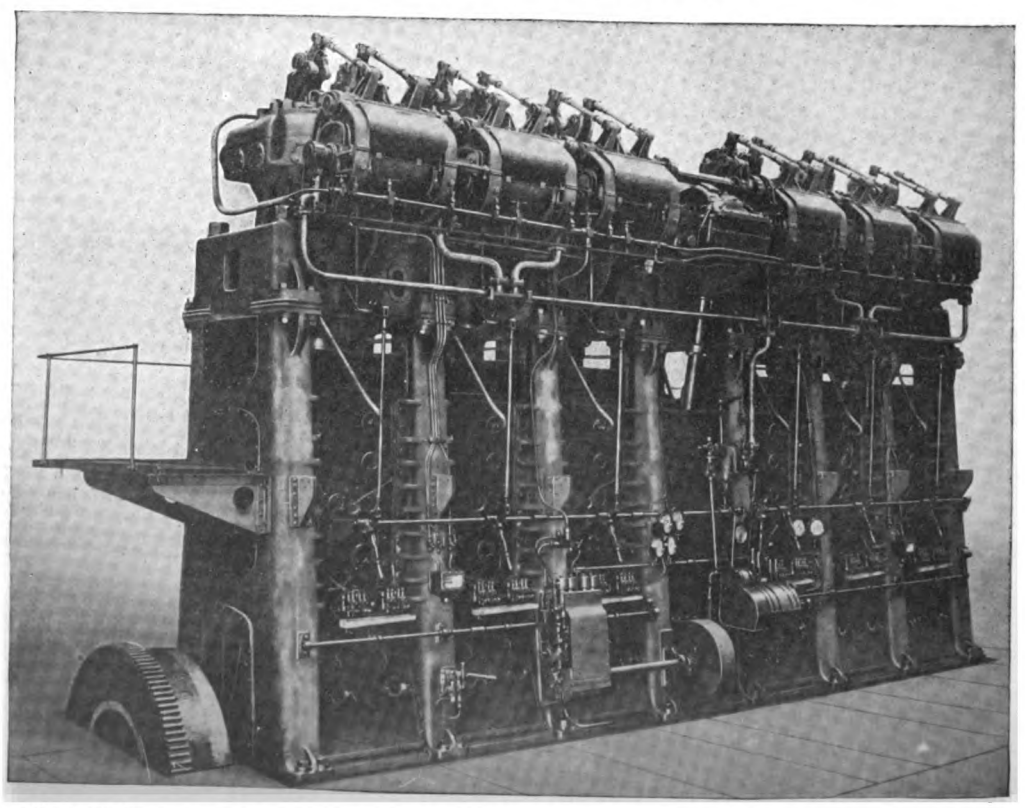
A LETTER TO MOTORSHIP'S SISTER MAGAZINE

(By kind permission of the Editor of *Fishing Gazette*)

To the Editor of FISHING GAZETTE:

You will note that we are subscribers to MOTORSHIP, and as you seem to have some connection with that magazine we do not think it out of place to say that MOTORSHIP is without question the finest publication of its kind in America and is doing a great work in waking the American shipowner up to his possibilities in showing him the economic value of the Diesel engine. Why the said shipowner seems to persist in his Rip Van Winkle sleep is beyond the reasoning powers of those of us who know the facts.

Jacksonville, Fla., D. J. CARRISON.
March 3rd, 1922.



One of the twin Vickers 1,250 shaft h.p. airless-injection Diesel-engines of the new tanker "Scottish Musician"

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